

January 1990/\$3.00

Mobile Radio Technology

The journal of mobile communications technology

Site management, p. 10

Specialized mobile radio
Packet radio

AN INTERTEC PUBLICATION

New **as** Base Antennas: the perfect fusion of design, performance and reliability.

You've heard nothing is perfect. But then, you may not yet have seen the outstanding ASP-2650 Series UHF metal dipole base station antennas.

They're improved from the ground up — that means new electrical and new mechanical designs, the best materials, careful construction techniques.

All blended together to give you antennas that perform as they claim.

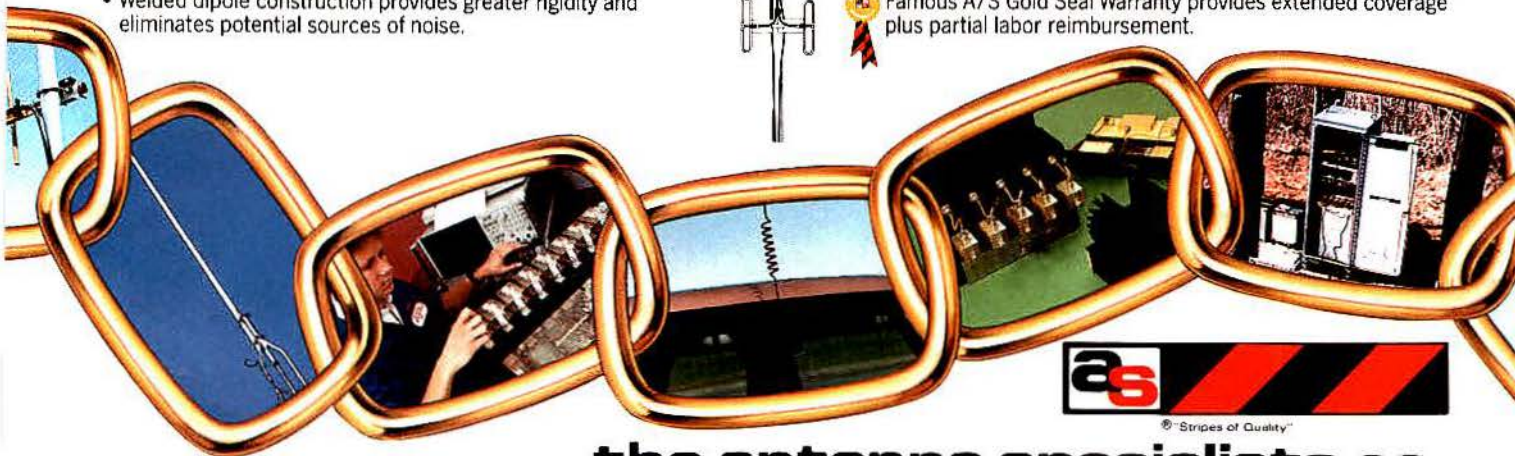
- Gold iridized solid aluminum dipoles and stainless steel mast clamps assure corrosion-free, dependable performance.
- Welded dipole construction provides greater rigidity and eliminates potential sources of noise.



- New, weatherproof, injection-molded cable joints lock out wind-driven rain and contaminants.
- Unique neoprene heat-shrink tubing "waterproofs" all splices.
- DC ground protects against lightning damage to equipment.
- Broadband models to cover the 450-512 MHz band are ideal for multiple transmitter combining or duplex systems.
- Eight models in omnidirectional, elliptical or directional configurations with gain from 5 to 11 dB to accommodate your system design requirements.



Famous A/S Gold Seal Warranty provides extended coverage plus partial labor reimbursement.



® "Stripes of Quality"™

the antenna specialists co.

A Member of The Allen Group Inc.

30500 Bruce Industrial Parkway • Cleveland, OH 44139-3996
TEL NO: 216/349-8400 • FAX NO: 216/349-8407

we're the specialists in the whole chain of RF command

SITE MANAGEMENT SERVICES • TRANSMITTER SITE ACCESSORIES • CELLULAR
BOOSTERS AND REPEATERS • COMMUNICATION ANTENNAS

Circle (1) on Fast Fact Card

End console clutter...



...with the C-516 six-line tone remote

Clear your desk...and control up to six base stations with only one standard telephone-size console! Vega's Model C-516 is the only small desktop tone remote that provides F1/F2/monitor/PTT control of up to six remote base stations. It operates over two-wire/four-wire lines and includes line-activity indicators and selected or summed receive audio.

The C-516 is only one of a wide variety of remote control consoles available from Vega. Check the following list for the console that fits your application:

Handset versions

- C-530 DC (single frequency)
- C-531 DC (two frequency)
- C-510C tone (two frequency)
- C-514B tone (four frequency)
- C-516 tone (six line, two frequency)
- C-581 tone (eight frequency)

Desk-mic versions

- C-532 DC (two frequency)
- C-511 tone (two frequency)
- C-540 tone (coming later...four frequency, 10 line)
- C-581/M tone (eight frequency)

Wall-mount versions

- C-533 DC (two frequency)
- C-512 tone (two frequency)

Custom versions

- Multiline/multifrequency
- Special mechanical configurations

Vega

a MARK IV company

9900 Baldwin Place
El Monte, California 91731-2204
Telephone: (818) 442-0782
Toll-free: 800-877-1771
FAX: (818) 444-1342

Circle (4) on Fast Fact Card

features

10 Structure your site for 'technical' success

Al Dolgosh and Ron Jakubowski, Antenna Specialists

Part I—Use a checklist for guidance in putting together a structured site management plan. As control and cooperation improve, so do the site's noise floor and interference level—not to mention profitability!

16 Packet radio on fire's front lines

By Jim Hendershot, dBm Labs

Packet radio communications, developed into a network by amateur radio operators, support emergency communications conducted by the California Department of Forestry.

32 Airport data system combines two-way, packet technologies

James D. Fahnestock

At Syracuse, NY, an airport data system combines packet sets, VHF radios and inexpensive personal computers to relay vital real-time information among airport users.

42 Integrated system controller improves trunked SMR systems

Jim Bonnichsen and Larry Bess, Zetron

Integrating previously isolated trunked repeater functions into single system controllers improves interconnection and makes computer management easier and more flexible.

52 Index to 1989 features

Use this reference to find articles printed in 1989.

56 For your information

Here are some facts about MRT.

departments

4 Editorial

Unlicensed operation.

6 Letters to the editor

58 News

FAA lightning tests: Scientific or not?

60 ACT update

62 Regulating technology

64 New products

Cushcraft/Signals, Sti-Co, Europa Marketing and Trycomm are the "Readers' Choice."

71 Literature

72 Feedback

73 People

74 Calendar

American SMR Network Association meets in San Antonio, TX.

76 Classified ads

88 Ad index/hotline

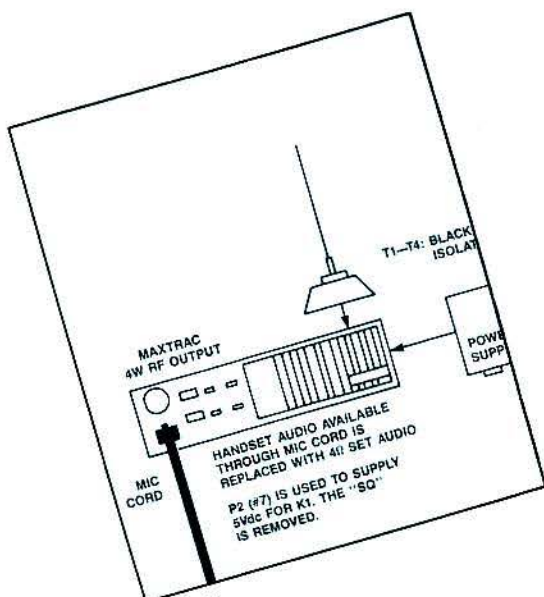
Find advertisers quickly.

89 What do you think?

What equipment is the most difficult to install?



page 10



page 32

On the cover: A crowded rooftop antenna site in San Francisco is an example of an installation that demands the best available site management plans and skills. A multipart series on site management begins on page 10.

©1990 Mobile Radio Technology (ISSN 0745-7626) is published monthly for free to qualified individuals by Intertec Publishing Corporation, 9221 Quivira Road, Overland Park, KS 66215. Second-class postage paid at Shawnee Mission, KS, and additional mailing offices. POSTMASTER: Send address change to MOBILE RADIO TECHNOLOGY, P. O. Box 12960, Overland Park, KS 66212.

A New Generation of Response Signalling...



Model 364 AW
DTMF Multi-function
Decoder/Monitor/Controller

- **AUTOMATIC VERIFICATION**
audible handshake indicates completed or aborted functions
- **EASY STATUS INTERROGATION**
a touch-tone pad, voice channel and your ear is all you need
- **SYSTEM MONITORING**
audible alarms will automatically signal critical conditions
- **SSC APPLICATIONS SUPPORT**
experienced personnel will help you find the best solution for your users
- **MICROPROCESSOR FLEXIBILITY**
wide range of available controls (latched, timed, momentary, interlocked, etc.)
- **STRAIGHTFORWARD USER SELECTION**
complete manual with tutorial, demo set-up and helpful systems feedback
- **PROVEN RELIABILITY**
fully field-tested and FCC certified (class A) plus our established 5 year warranty

Call now for full information package:

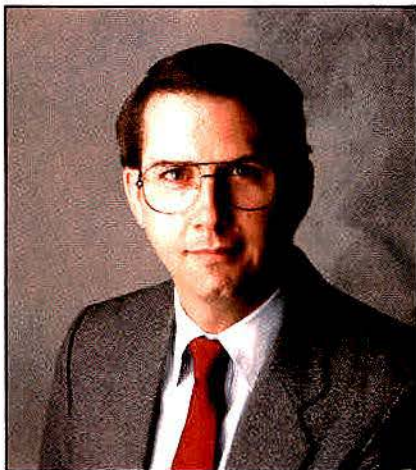
800-227-1226

One source for all your signalling needs

SSC

SOLID-STATE COMMUNICATIONS, INC.
21060 Corsair Boulevard
Hayward, California 94545

Circle (5) on Fast Fact Card



Unlicensed operation

We called a vendor who advertises "high-performance cordless telephones" in an airline's in-flight magazine. These telephones amount to interconnected two-way radios with 2W to 30W base station power. What advice we got!

This is a composite of a 30-minute conversation with the vendor:

What frequency do I use?

You can pick any frequency in the VHF or UHF bands.

What frequency do you recommend?
Any frequency you want.

No, really, how do I find a frequency?
Do you have a scanner?

Yes.

Set your scanner to listen on 470.125MHz and every 25kHz up from there. If you hear frequencies that are clear, you can use one of them.

Aren't those frequencies part of UHF-TV channel 14?

Yes, they are. That's why, if you don't have a station in your city, the frequencies probably will be clear.

But I want to use my telephone on a legal frequency.

Then try listening from 420MHz to 440MHz.

Isn't that a ham radio band?

Yes, but you can use it.

For business?

That depends on what you mean by business.

Isn't there a legal, business radio frequency I can use?

OK, set your scanner to listen to 461.0125MHz and every channel up from there at increments of 25kHz. Also channels 5MHz higher for your duplex frequency. When you find a frequency you like, tell us and we'll set your telephone for it.

Don't I need a license?

You don't need a license for the first 30 days to try it out.

What about the "ring-out feature" whereby when someone calls my phone number, my phones at home ring, as well as my mobile or portable phone? Wouldn't my base station signal cause interference if someone already is using the frequency?

No, the frequency is yours alone.

You mean I can get an exclusive assignment?

The FCC won't put anyone else on your frequency once you get a license.

How do I get a license?

You only get a license if you want to. We send you the papers, but what you do with the radio equipment is up to you. If you want a license, we will help you get one.

Bad advice

This advice hardly could have been less correct. The vendor cares nothing for present users to whom his customers may cause interference. Concern for his customers is lacking because advice that leads the unwary into illegal radio operations is no prize.

As far as the vendor is concerned, if you receive interference from telephone conversations broadcast on frequencies not intended for interconnected two-way radio, it is up to you to sic the FCC on 'em. Thanks a lot.

We called the equipment manufacturer, too. Although his information was more accurate, one comment did not convey respect for licensing. "Business radio is self-policing, like the ham bands," he said. "You could get away

with using the mobile telephone for quite a while before enough people complained to get the FCC to move on you. But if enough co-channel users hear dial tones and phone conversations tying up their channel, they'll complain."

Unlicensed operation has the attention of the FCC's top enforcement official, field operations bureau chief Richard Smith: "Without licensing, the rest does not matter. If someone operates anywhere in the spectrum he wants, what does it matter that the commission has allocated some frequencies for a particular radio service? What difference does it make that the commission requires a license for entry and some kind of sorting out and control of those who operate in the spectrum in an orderly way?"

Smith continued: "What difference does it make that the commission has established technical standards having to do with things such as emissions and frequency stability and operating power and so forth if the basic requirement of a license is not complied with? So the regulatory scheme seems to me in danger of breaking down rather quickly and rather violently if we don't turn that trend around. That's why I'm concerned about unlicensed operation."

We're glad Dick Smith is concerned.

Don't you wish *all* vendors were, too?

—Don Bishop

PRIVACY

Volume 1, No. 4

NEWS
from
transcript

NEW TECHNOLOGY FOR TODAY'S RADIOS

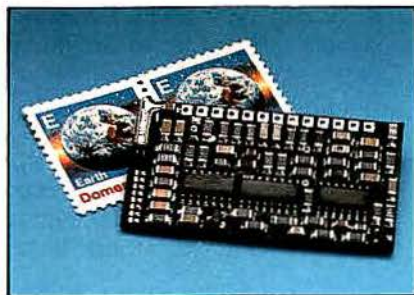
Nobody does it better

VOICE PRIVACY

Whether you need four codes or four billion, Transcript has the reliable system for your radios.

Now with advanced features like ANI, Status reporting and Selective Calling, Transcript's CVP™ is unmatched by any other system.

Specified and depended on by major users and governments world wide.



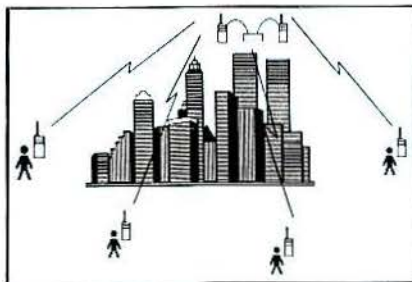
Transcript's voice privacy modules go to work every day in over 400 different makes and models of radio.

Instant Repeater

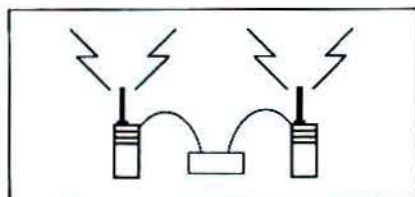
Whether fighting forest fires in the Northwest or providing emergency communications after a hurricane, Transcript's remarkable TransPeater™ goes to work faster than any other system.

Using programmable radios, simply connect the TransPeater™ between any two units (portable, base or mobile) using existing micro-

phone/speaker connections.



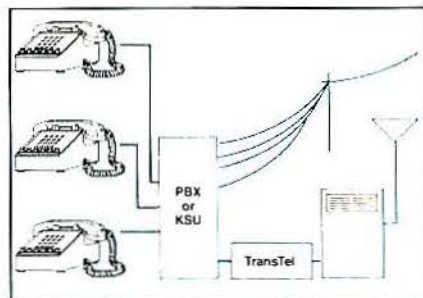
Transcript's TransPeater™ provides instant repeater service



Transcript's TransPeater™ easily connects two radios as a repeater

Unique Remote

Control a base station using your existing telephone system. A single TransTel™ replaces costly remotes and permits control of the base from any telephone extension. (DTMF required)



Transcript's TransTel™ replaces remotes

Bendix/King Users

Special upgrades for KING portables in VHF & UHF. Plug in options for unit to unit selective calling, voice privacy and more. Also a new low cost 28 channel conversion for the VHF LPH series.



transcript/international INC.

**Toll-Free (800) 228-0226 Telex 466146
1620 North 20th Street, Lincoln, NE 68503**

Frequency coordination:

We feel that many of the complaints that have been printed about services provided by some frequency coordinators are unjustified.

We deal with the National Association of Business and Educational Radio (NABER) and the Special Industrial Radio Service Association (SIRSA) on a regular basis and the level of service we receive from both organizations is, to say the least, excellent.

The frequency coordination process, in general, is working well. Although improvements always can be made in any business or organizational process, many of the complaints that appear in print come from individuals or organizations that either do not understand the established procedures or they have selfish motives that are not in the best interests of the majority of land mobile radio system users in the United States.

If all applicants and licensees adhere

to the proper procedures and are truly interested in a fair process for all, then they will work within the frequency coordinators in a constructive way to improve the system. Any problems that we have had, have been resolved quickly by working directly with the frequency coordinators.

Tactics being employed by some of the complainants to discredit the frequency coordinators and the present coordination process is counterproductive and, in fact, destructive. It can only be viewed as an irrational reaction resulting from problems that probably have been created either because the complainants did not abide by the rules or they want sufficient loopholes so they can circumvent the rules to suit their own needs.

Fred Palidor

Palidor Radio Communications

Consultants

North Vancouver, British Columbia

Fast Fact Card comments:

Without *MRT* I would be out of business. It keeps my staff and me up to date on new technology and new vendors.

The most difficult problem is a few customers who want excellent communications but who are not willing to purchase excellent mobiles and portables.

Frank Layton

Operations Officer

Emergency Rescue

Communications Specialists

Sunnyvale, CA

The most interesting article in the August 1989 issue is "Universal Vehicular Repeater Extends Portable Range" by Wes Sutton. I'm working on a system now. Thanks!

David Merkel

Communications Link

Powell, WY

Mobile Radio Technology

The journal of mobile
communications technology

EDITORIAL

Don Bishop, *Editorial Director*

Jane Bryant, *Staff Editor*

Tom Cook, *Senior Managing Editor*

Tim McNary, *Editorial Assistant*

Jennifer Hinkle, *Group Editorial Assistant*

ART

Terri Blunt, *Graphic Designer*

INDUSTRY CONSULTANT

Fred M. Link

EDITORIAL ADVISORY BOARD

Gene A. Buzzi, *President, Omnicom*

Telecommunications Engineering,

Tallahassee, FL

R. James Evans, *Communications*

Consultant, East Lansing, MI

Gary David Gray, P.E., *Chief*

Telecommunications, Orange, CA

Frederick G. Griffin, P.E., *President,*

Frederick G. Griffin P.C., Lynchburg, VA

S.R. McConoughey, P.E., *Mobile*

Communications Consulting,

Gaithersburg, MD

Art McDole, *Director of Communications,*

Monterey County, CA

F. Stuart Meyer, *Land Mobile Consultant,*

Vienna, VA

Herb Sachs, *Herb Sachs Consulting, Bowie*

MD

Leon Spencer, *Radio Engineering Systems,*

Exxon Company USA, Houston, TX

Dr. Gregory M. Stone, *Senior Director,*

Science and Technology, Analytics,

Willow Grove, PA.

Kenton Sturdevant, *Assistant Vice*

President, Forest Industries

Telecommunications, Eugene, OR

Raymond C. Trott, *President,*

Raymond C. Trott Consulting

Engineers, Irving, TX

BUSINESS

Cameron Bishop, *Group Vice President*

Mercy Contreras, *Associate Publisher/*

National Sales Manager

Greg Garrison, *Marketing Director*

Evelyn Hornaday, *Promotions Manager*

Dave Kimmis, *Promotions Coordinator*

Dee Unger, *Advertising Business Manager*

Liz Turner, *Advertising Coordinator*

Kevin Callahan, *Creative Director*

ADMINISTRATION

R. J. Hancock, *President*

Charles Rash, *Corporate Circulation*

Director

Sandra J. Stewart, *Circulation Director*

Julie Neely, *Circulation Coordinator*

Customer Service, (913) 541-6628

ADVERTISING: East: Ruth Breashears, 303-

762-1249; West: Dennis Hegg, 415-491-1442;

Midwest: Diane Hite, 303-762-1249; Classified:

Carla Gamino, 303-762-1249.

MOBILE RADIO TECHNOLOGY provides technical information to dealers, community repeater operators, specialized mobile radio operators, conventional RCC, WCC, cellular RCC, WCC, mobile radio equipment manufacturers, manufacturers' representatives, distributors, engineering, consulting firms, national government, military agencies, state/local government, public safety agencies, transportation companies, petroleum/energy products companies, public utilities and others allied to the field.

CORRESPONDENCE: Editorial, advertising and circulation correspondence should be addressed to P. O. Box 12901, Overland Park, KS 66212-0930, 913-888-4664, telex: 42-4156 INTERTEC OLPK, fax: 913-541-6697.

SUBSCRIPTIONS: **MOBILE RADIO TECHNOLOGY** is circulated without charge in the United States by name and title to personnel who are responsible for sales, operation or maintenance of mobile radio equipment. Non-qualified subscriptions in the United States are \$30 per year; In Canada, \$36 per year; and in other countries, \$40 per year. Foreign airmail optional at an additional \$65 per year. Single copies are \$3 plus postage and handling; back issues, \$5 plus postage and handling. Adjustment necessitated by subscription termination at single copy rate. Allow six to eight weeks for change of address or for new subscription.

PHOTOCOPY RIGHTS: Permission to photocopy for internal or personal use is granted by Intertec Publishing Corporation for libraries and others registered with Copyright Clearance Center (CCC), provided the base fee of \$2 per copy of article is paid directly to CCC, 21 Congress St., Salem, MA 01980. Special requests should be addressed to Cam Bishop, group vice president.

\$3.00 + 0.00

VBPA ABP

Audited circulation.

**INTERTEC
PUBLISHING**

©1990 by Intertec Publishing.
All rights reserved.

Increase Your Bottom Line with...

Our Product

Line

Enhance Your Existing Two-Way System with . . .

CES DTMF Encoding Microphones, Handsets, and encoder pads for hand held radios, fully automatic Telephone Interconnects, and complete Community Radio Telephone Terminals with Call Accounting and Billing Facilities. CES is the undisputed leader in radio-telephone interconnect with a genuine commitment to dependability. We're large enough to supply your requirements, yet small enough to give you the personal service you deserve. Call our sales department today and let us help you maximize your radio system profits!

Make The **RIGHT** Connection

CES

**Communications
Electronics
Specialties, Inc.**

931 S. Semoran Blvd., Suite 218
Winter Park, Florida 32792
National: (800) 327-9956
Local: (407) 679-9440 FAX: (407) 679-8110



RM-10CA
Repeater Maker



NEW



SDI-50 Simplex/
Duplex Interconnect



ACI-35 Simplex Vox
Control Station Interconnect



5200 Community
System Interconnect



3500 Remote Data
Storage Station



DID-50 DID Selector
Level Interface

Letters to the editor

Ignition noise:

I recently purchased a 1989 Ford Ranger pick-up truck in which I installed a two-way radio.

Much to my amazement, there was a large amount of ignition noise from the electric fuel pump. I have tried everything at my disposal to remedy the problem. I put a filter in the dc line to the set, bonded the engine to the frame, the

hood to the frame and the exhaust system to the frame, all for nothing.

The noise is coming in via the antenna. I use my radio on 154MHz for a volunteer fire department. I might add that any highband two-way radio operated within 8 feet of the truck suffers the same noise. It appears my truck is one big noise transmitter and antenna.

Are any other operators having the

same problem with highband radios and the 1989 Ford Ranger with the V6, 2.9 liter engine? If you could be of any assistance on this problem, would you contact me with any information you have?

Dennis H. Cody
Cody's Communications
1314 Sudbury
Pasadena, TX 77504

Fast Fact Card comments:

MRT is interesting, informative and well written. I look forward to every issue.

The toughest problems faced on the job are finding intermittent faults in equipment and obtaining good-quality parts.

Michael S. Sage
Radio Technician
Charlotte, NC

The May 1989 issue was excellent! It addresses some important issues. Almost every edition of the magazine addresses a problem we have encountered at one time or another, with some simple, easy solutions for some of them.

David W. Milliren
Emergency Medical Technician
and 9-1-1 Dispatcher
Knox, PA

Mobile radio installation:

I sure enjoy and appreciate *Mobile Radio Technology*. The August 1989 issue was especially good.

The letter to the editor concerning installation of mobile radios was interesting. I agreed with some points and disagreed with others.

One I did not agree with involves connectors: crimped and soldered. You simply cannot beat a good soldered connection. Crimp connectors and terminals work loose and cause problems. If such a connector or terminal is not applied properly the first time, it is ruined, whereas with a solder connector, it can be reapplied to correct a problem.

But, as they say, you can't please all the people all the time.

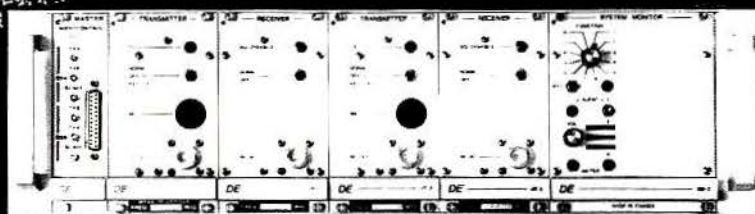
Please continue to send me *MRT*; it is good reading.

Doyle F. Mayse
Larned, KS



THE PEAK PERFORMER

MT-2 SERIES MOUNTAIN-TOP REPEATER



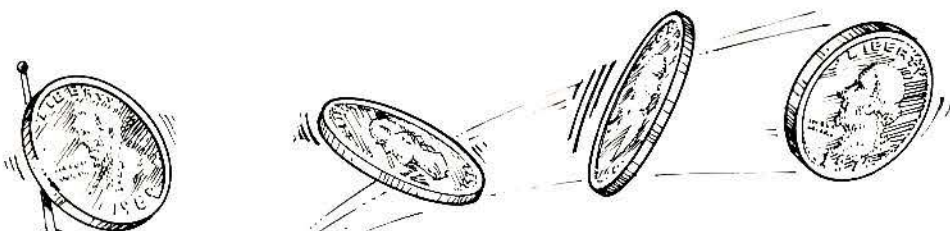
THE ULTIMATE IN RUGGED AND
DEPENDABLE SOLAR POWERED
REPEATER COMMUNICATIONS

AVAILABLE IN VHF AND UHF
(138-512 MHz) COMBINATIONS

**DE DANIELS
ELECTRONICS**

43 ERIE STREET, VICTORIA, B.C.
CANADA V8V 1P8
PHONE: (604) 382-8268 FAX: (604) 382-6139

Circle (8) on Fast Fact Card



Plug In More Repeater Profits

A Phone, a PC and the P39
Turn Idle Airtime into Money.

Automatic overlay paging answers the phone, stores messages while your 2-way system is busy, and sends pages when the system is idle. It doesn't step on your 2-way customers and it makes you money selling pages. It's like found money... *every month!*

It's as simple as plugging our MX P39 Radiopaging Computer Card into an option slot of any IBM® PC or PC-compatible, where it stores voice and data messages for transmission during idle airtime.

To plug in an MX P39 and more
repeater profits, Call Toll Free:
1-800-638-5577

MX P39 Radiopaging
Computer Card

MX • COM, INC.

4800 Bethania Station Road, Winston-Salem, NC 27105-1201
In North Carolina Call: (919) 744-5050 or FAX (919) 744-5054
In Canada Call: Omni • East/514-648-8432 • Central/416-841-6740 • West/403-291-9639

IBM/Reg. TM International Business Machines Corp.

Circle (9) on Fast Fact Card



Structure your site for 'technical' success

Part 1—Use a checklist for guidance in putting together a structured site management plan. As control and cooperation improve, so do the site's noise floor and interference level—not to mention profitability!

By Al Dolgosh and
Ron Jakubowski

Most of the desirable radio communications transmitter sites have something in common: a commanding view of a wide area. A desirable site may be atop a steep hill or a mountain. It may be a tall tower or the tallest building in town.

The number of users who place equipment and antennas at a poorly managed site grows until the tower becomes overloaded and falls down or until mutual interference among site users becomes so intolerable that the site becomes unattractive to any additional users. Up to the point of tower failure, an unsophisticated site owner may *think* he has done his job adequately as long as the monthly rent is collected and as long as he knows who has keys to the site.

The site manager

A simplified job description for a site manager might read, "To control all system components connected to the RF transmitting and receiving equipment to maintain a noise-free and interference-free site that is safe and profitable. This control extends to accessories equipped with microprocessors and other equipment covered under FCC Part 15 RF emission limits."

Delegating this responsibility to one person or company is preferable. But cooperative management among several individuals or organizations may be

Dolgosh is director of sales and marketing services, and Jakubowski is systems engineering manager at Antenna Specialists, Cleveland.

Site management checklist

- ☐ **Intermodulation interference**—Keep an updated study on hand.
- ☐ **Maintenance logs**—Require all maintenance workers to record changes made.
- ☐ **Frequencies in use**—List who operates on each frequency.
- ☐ **Field measurements**—Take signal strength readings regularly.
- ☐ **Monitor system**—Equip unattended sites with alarms.
- ☐ **Generator and battery backup**—Provide emergency power if the site includes users with critical communications needs.
- ☐ **Fire extinguishing**—Be prepared for fire emergencies.
- ☐ **Grounding**—Safeguard the site against damage from lightning.
- ☐ **Antenna design**—Use welded assemblies whenever possible to prevent intermod and reduce the noise floor.
- ☐ **Propagation design**—Take tower-antenna interaction into account.
- ☐ **Running a business**—Don't forget security, insurance, liability and rental agreements.

workable for sites with fewer users. Either way, all the users must cooperate for the site to be managed.

For a new site manager, control over the equipment at the site and the degree of cooperation displayed by the users quickly may become a matter of overwhelming concern, especially if a problem arises suddenly. Using a structured approach to site management makes it easier for the manager to keep the site under control and to resolve conflicts between users.

Structured management addresses the following:

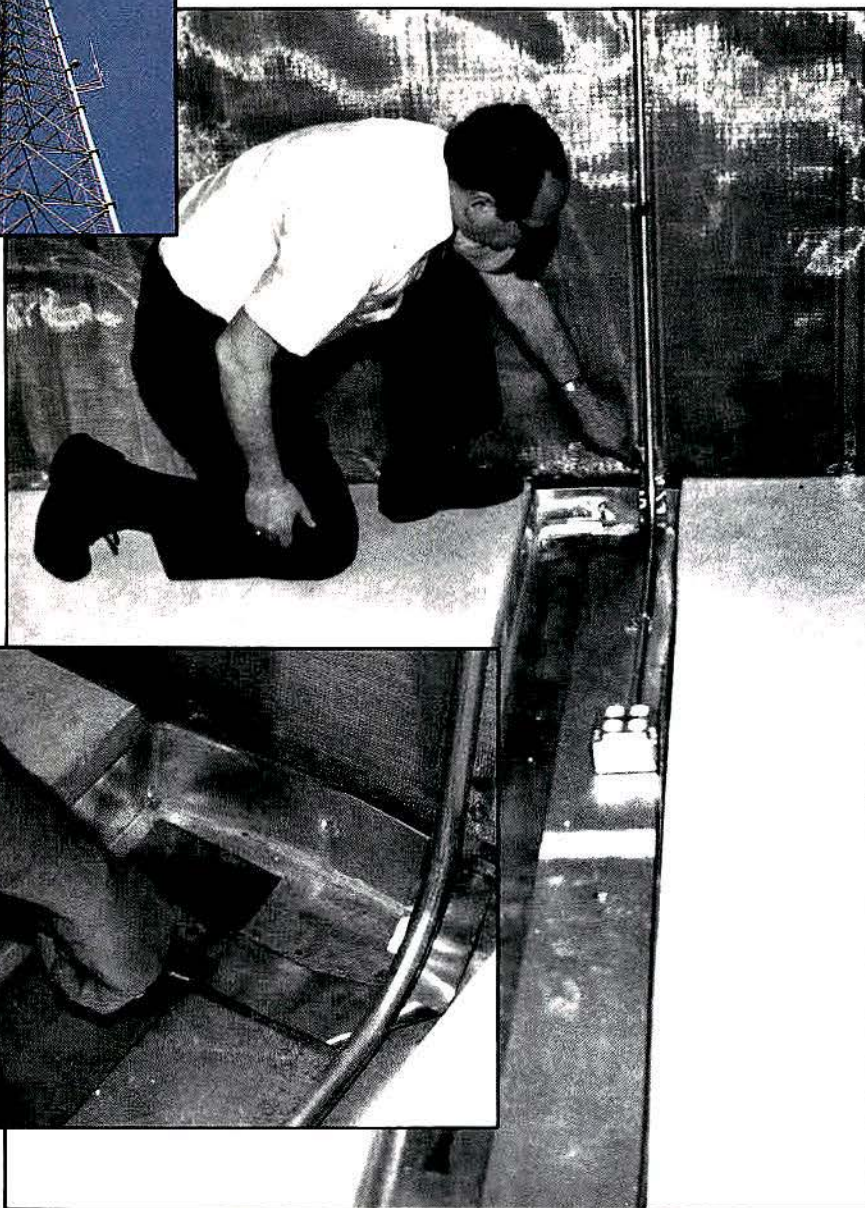
- **Intermodulation interference**—Undertake a complete intermodulation interference (intermod) study.

Update the study at intervals to reflect changes made at the site and detect potential interference problems.

Horizontal separation of antennas offers greatly reduced isolation compared to vertical separation, so the study must include all frequencies used by equipment within a quarter-mile or more of the site. Remember to include AM, FM and TV broadcasting frequencies.

- **Maintenance logs**—Keep a master log that records repairs, changes and additions made by any site user. The log helps in tracing the source of interference that may arise later.

Practice preventive maintenance regularly. But remember, "If it ain't broke,



The man in the photo points to the place where the ground strapping is bonded to the power source via conduit. The inset shows how ground strapping inside the equipment room should be welded at joints.

don't fix it!"

- **Block diagrams**—Keep a master layout that shows the site "plumbing," including what is connected to every combiner and antenna and the relative positions of isolators and filters used in the system.

- **Frequencies in use**—List the frequencies in use at the site. The list saves time when you have to troubleshoot a problem and identify licensees.

- **Field measurements**—Maintain a log of measurements made regularly from a fixed site, such as the service shop. The readings may be made with

most service monitors. The readings indicate relative transmitter signal strength and receiver sensitivity thresholds for all site equipment. As long as the same fixed antenna is used to make the measurements, changes in readings may indicate a potential equipment problem. A yagi is a type of fixed antenna commonly used for the purpose.

- **Monitor system**—Most sites are unmanned. If yours is, too, install a monitor system to indicate equipment conditions that stray outside normal operating limits, such as high VSWR and low RF output.

Select a system that sounds an alarm when site security is breached.

Many systems offer other useful measurement capabilities, too. Units are available that automatically dial a telephone number to send an alarm. Some communicate with a remote operator via a modem and terminal.

- **Generator and battery backup**—Depending upon the priority given to maintaining uninterrupted communication, consider whether to provide emergency power.

It is common to find emergency power available at sites used by broadcasters and sites developed with large buildings. Emergency power is a sales feature for a site, a feature that commands higher rent from some users.

- **Fire extinguishing systems**—A radio communication site environment often is among those that are at a high risk for lightning strikes. Moreover, large quantities of electronic equipment normally are installed at the site.

Aside from the effect the risk may have on insurance rates, building codes written for radio communications sites often require the installation of a fire extinguishing system. Systems that deliver non-contaminating gas, such as Halon, have been favored at many sites because they do not leave a residue.

- **Grounding**—Proper grounding is essential to safeguard equipment against lightning damage.

Although the subject has been treated by many magazine articles, it remains one of the most important and misunderstood aspects of site management.

Tower equipment selection

Although the site manager can inspect equipment installed at ground level, not all managers climb towers. Thus, the manager must select a steeplejack who can be relied upon to install tower-mounted equipment according to the structured management plan.

Select hardware that resists corrosion, such as hardware treated with a hot-dipped galvanized finish. Stainless-steel hardware resists corrosion the longest, but it may be prohibitively expensive. All connections must be securely tightened. When a connection is clamped to a painted tower leg, make the extra effort to bond the clamps to the tower. For example, scrape the painted surface.

Our Power-Packed Line-up Awaits Your Call.

When you need batteries you need them now.

You need Centurion.

We've been one of the leading suppliers of batteries to the communications industry for over 10 years. So our nationwide distribution network is experienced in keeping what you need in stock.

And on those rare occasions when your requirements go beyond what your nearby distributor has on the shelf, Centurion can quickly supply him with what you need. Our large standing inventory and computer-assisted order processing will speed your order on its way — often the same day.

Centurion's strict quality control assures you of a dependable product. We provide batteries and antennas to a majority of the radio equipment manufacturers, so you know we're dependable.

We offer a complete line of batteries and battery packs for virtually every communications power requirement, from portable radios to cordless telephones — even customized equipment.

*New! Extra-High Capacity
1200 MAH Batteries at 900
MAH Prices! **

Extra-High Capacity Batteries Available
(900 MAH still available.)

	Existing MAH	Centurion	New MAH
Motorola HT600	900	HT4585E	1200
Motorola MT1000-MTX800	900	MT4824E	1200
Radius P200	900	PR5521E	1200
GE PR/MUP Series	900	PR2524E	1200
GE MPR/MPS	900	MP1000G	1200
GE MPX	900	MP1000B	1200
Bendix King	900	KR0105E	1200

For the name of our distributor nearest you, or for emergency orders, call toll-free 1-800-228-4563. Or FAX us direct, toll-free, at 1-800-848-DUCK (3825).

*Limited time only.

Visa or Mastercard accepted.

GSA Contract No. GS07F19091.

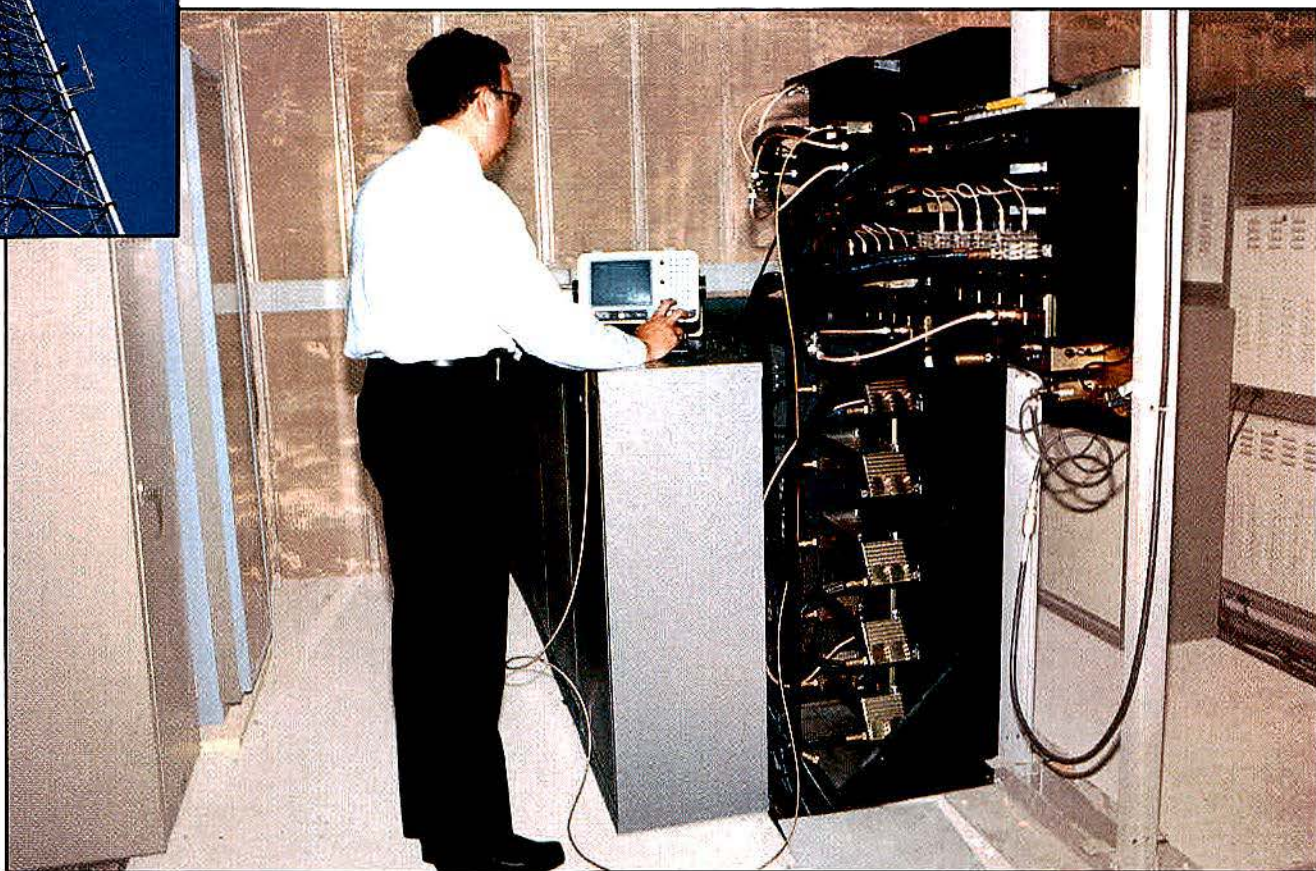
CENTURION

INTERNATIONAL, INC.

P.O. Box 82846

Lincoln, Nebraska 68501 U.S.A.





Take regular maintenance log readings to ensure peak performance. Keep a master log that records repairs, changes and additions made by any site user. The log helps in tracing the source of interference that may arise later.

clean it with a wire brush and repaint the area when the connection is made. Strap-bonding and welding are other alternatives.

The object is to create a low-impedance joint that does not generate intermod products and that gives maximum lightning protection.

The equipment shelter and all the equipment it contains should be bonded and grounded properly to keep the site noise floor as low as possible.

- **Antenna design**—Designing hardware with its RF implications in mind is important. Many noise and intermod problems stem from loose connections or connections that are partially conductive. Always choose welded construction instead of nut-and-bolt fasteners, when you have a choice. Discuss your applications with the antenna supplier's system engineering group for recommendations.

- **Propagation design**—Who says all systems sharing a site will cover the same area? Next to "height above terrain," the most important factor that in-

Job description: site manager

To control all system components connected to the RF transmitting and receiving equipment to maintain a noise-free and interference-free site that is safe and profitable.

This control extends to accessories equipped with microprocessors and other equipment covered under FCC Part 15 RF emission limits.


fluences coverage is the practice of mounting antennas alongside the tower instead of on top.

The larger the tower face, the more effect it has on a side-mounted antenna's coverage. The tower acts as a passive reflector that may aid or hinder efforts to cover a particular area, depending on the antenna placement relative to the tower face and its distance from the tower.

As with the hardware design, it is a good idea to consult the antenna supplier's system engineering group for recommendations about antenna

mounting.

- **Running a business**—Technical advice does not cover all the aspects of site management. Some of the other aspects include security, insurance, liability and rental agreements. Depending upon the ownership arrangements and the relationships between the various parties, certain aspects of the business may receive more attention than others. Legal counsel may offer answers to questions about these subjects.

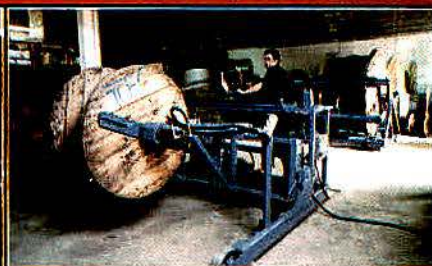
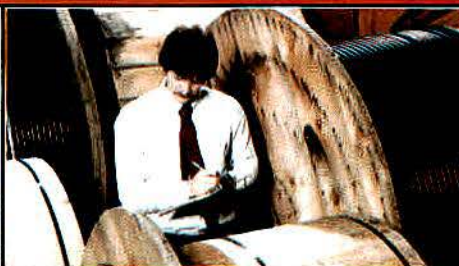
The next installment in this series explains how to recognize and resolve interference problems at the site. 

CUT, CONNECTED & DELIVERED!

ANDREW® HELIAX®

ANDREW® HELIAX®

800-638-7666



WE'LL GO TO ANY LENGTH TO MEET YOUR CABLE NEEDS.

When you need Andrew Helix® coaxial cable in a hurry, make sure you call the right place. TESSCO stocks high quality Andrew cable in depth at its regional distribution centers. No matter where you are located, there's a TESSCO distribution center ready to serve you and ship your order... fast.

No minimum purchase is required. Sophisticated cable handling equipment is used to cut your order to exacting specifications. There's no reason to purchase more or less than you actually need.

Connectors can be expertly installed at a nominal charge.

Don't tie up your technician's time with installing connectors when TESSCO can provide this service for you. A large variety of connectors are warehoused to match your cable size.

In addition to cable and connectors, TESSCO also carries a complete line of Base, Mobile and Portable Antennas, Accessories, Bench and Test Equipment. Call now 800-638-7666. Make TESSCO Your Total Source® for all your land-mobile communications needs.

TESSCO
Your Total Source

800-638-7666
FAX: 301-584-7450

Helix® is a registered trademark of Andrew Corporation.

GH1

Packet radio on fire's front lines

Packet radio communications, developed into a network by amateur radio operators, support emergency communications conducted by the California Department of Forestry. Hams provide technical assistance, too.

By Jim Hendershot

Ask a representative of any fire department what is needed the most in fighting a large fire and the answer usually will be: "resources."

Aside from people and machines, the biggest problem is communications. No

Hendershot is president of dBm Labs, Arroyo Grande, CA.

matter how well-equipped and staffed they are, emergency agencies never are fully prepared for those "really big" emergencies that sometimes happen.

'Oversized' emergencies

The California Department of Forestry (CDF) is one agency that specializes in oversized emergencies. In addition to its statewide responsibilities, CDF serves under a contract as the county

fire department for San Luis Obispo County.

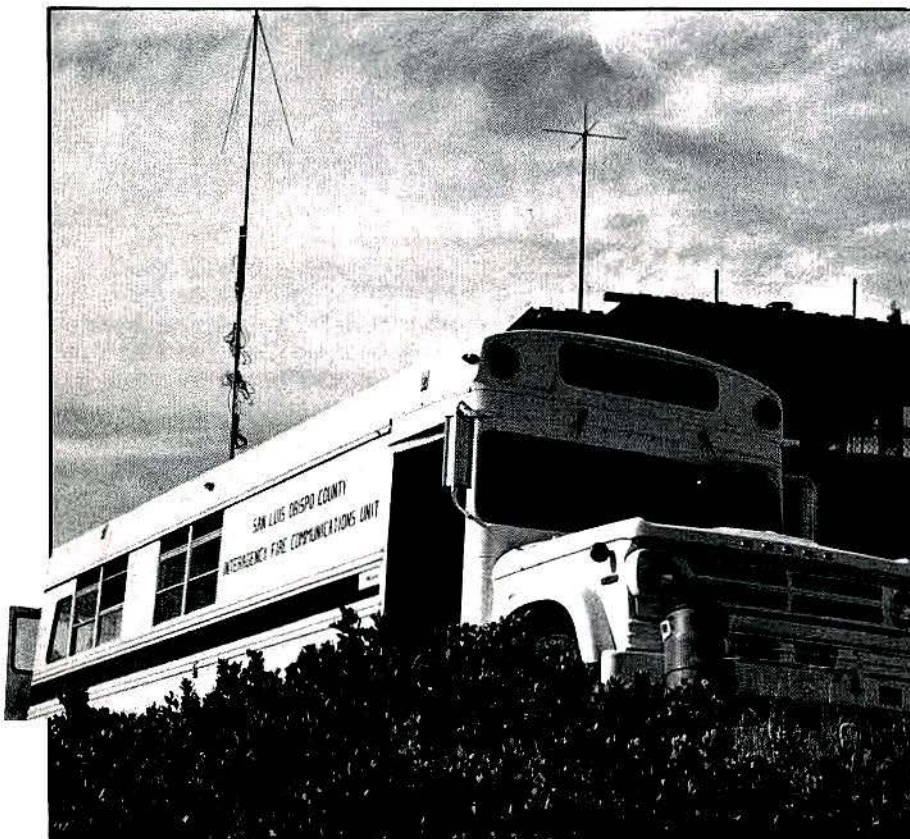
CDF is well equipped with radio communication equipment licensed in the public safety services. But CDF relies on another form of communication when its own equipment and staff are not enough—packet radio communication carried out by stations and operators licensed in the amateur radio service.

CDF captain Doug Blangsted works at the division's emergency command center in San Luis Obispo. A licensed amateur for three years, Blangsted serves as a volunteer coordinator of activities conducted by amateur radio operators to support CDF radio communications. With the help of radio amateurs, CDF has developed a packet radio communications network.

Packet radio exchanges written messages via radio. The written messages are converted to a digital data format for transmission and reception. The amateurs use packet radio to supplement CDF's normal communication channels.

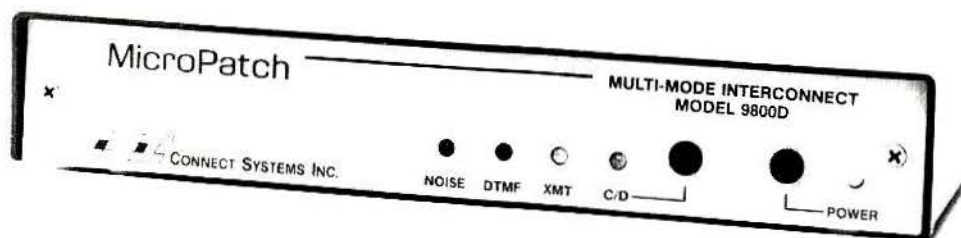
The sophisticated network spans several hilltop sites. For CDF, the network may be pressed into service to satisfy extraordinary communications requirements during efforts to extinguish major brush and forest fires. At other times, the network may be used in connection with other organizations to help coordinate even the smallest special events.

In 1984, when the Las Pilatas fire consumed firefighting resources faster than it consumed forest, the amateur packet radio system played a vital role in logistical communications to organ-



The California Department of Forestry command bus stationed at High Mountain during a brush fire contains public safety and amateur packet radio units.

Another Satisfied Customer!



Shouldn't your customers be using the best interconnect available today?

Next time specify a 9800 and discover the difference.

USER SELECTABLE MODES

1. VOX control station interconnect
2. Sampling interconnect (VOX enhanced)
3. Semi duplex interconnect
4. Repeater controller (private system)
5. Dial up remote base (operate and use base from any telephone)
6. Dial access paging
7. Talk back paging

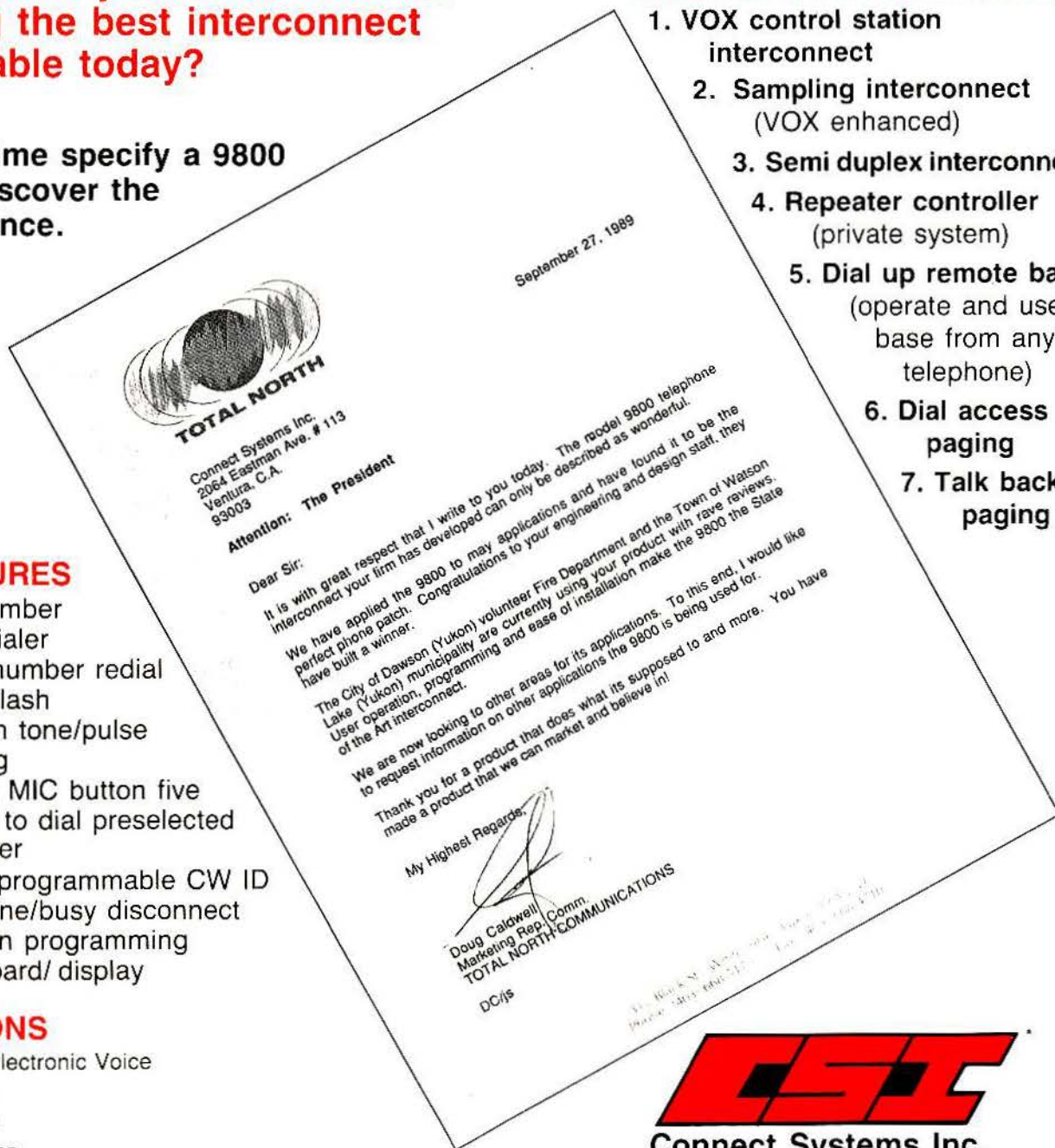
KEY FEATURES

- 90 number autodialer
- Last number redial
- Hookflash
- Regen tone/pulse dialing
- Press MIC button five times to dial preselected number
- User programmable CW ID
- Dialtone/busy disconnect
- Built-in programming keyboard/ display

OPTIONS

- EVD (Electronic Voice Delay)
- 2 Tone
- 5/6 Tone
- CTCSS
- Aux Relay
- Coupler

TOLL FREE
(800) 545-1349



Connect Systems Inc.
2064 Eastman Avenue, #113
Ventura, California 93003

Phone (805) 642-7184 • FAX (805) 642-7271

Circle (12) on Fast Fact Card



The California Department of Forestry command center in San Luis Obispo houses a public safety radio dispatch center (inset) for routine and emergency communications. Amateur packet radio facilities that supplement equipment the public safety system are shown on page 24.

ize human resources, materials and equipment.

During each Fourth of July holiday, volunteers from the ranks of amateur radio operators form fire watch patrols to help keep small fires from becoming larger.

Amateur packet radio supports communications at the annual fireman's muster, a kind of "fireman's Olympics."

Digital communications also play a role in the county's emergency plans for dealing with a potential accident at the Diablo Canyon nuclear power plant at Avila Beach on the nearby Pacific coast.

Communications methods

Many well-designed communications systems use several ways of communicating. So do the amateurs. One active group uses conventional FM voice communication. Their efforts have been augmented in recent years by the San Luis County packet system.

The biggest advantage the county derives from amateur use of several communications methods is a supply of

2-1000 MHz In One Sweep!

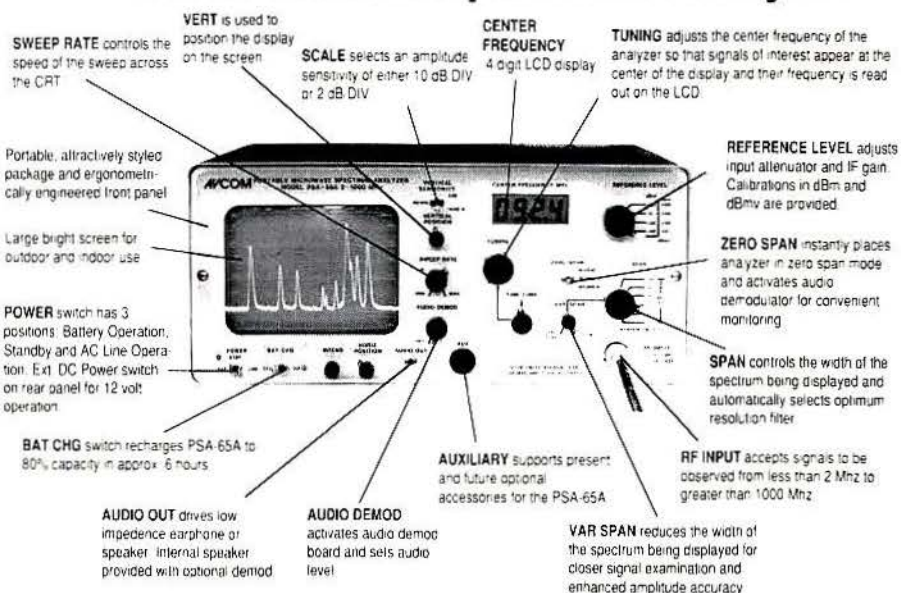
AVCOM's New PSA-65A Portable Spectrum Analyzer

The newest in the line of rugged spectrum analyzers from AVCOM offers amazing performance for only **\$2,855.**

AVCOM's new **PSA-65A** is the first low cost general purpose portable spectrum analyzer that's loaded with features. It's small, accurate, battery operated, has a wide frequency coverage - a must for every technician's bench. Great for field use too.

The **PSA-65A** covers frequencies thru 1000 MHz in one sweep with a sensitivity greater than -90 dBm at narrow spans. The **PSA-65A** is ideally suited for 2-way radio, cellular, cable, LAN, surveillance, educational, production and R&D work. Options include frequency extenders to enable the **PSA-65A** to be used at SATCOM and higher frequencies, audio demod for monitoring, log periodic antennas, carrying case (AVSAC), and more.

For more information, write, FAX or phone.



AVCOM

BRINGING HIGH TECHNOLOGY DOWN TO EARTH

500 SOUTHLAKE BOULEVARD
RICHMOND, VIRGINIA 23236; 804-794-2500
FAX: 804-794-8284, TLX: 701-545

BUILT TO GO THE DISTANCE



QUALITY. When you buy a Repco two-way radio, you get what you pay for—no-nonsense operation from a radio that stays on the job day in, day out, day after day.

EXPERIENCE. Quality construction and rugged reliability are nothing new at Repco. For more than a quarter of a century we've been manufacturing and shipping professional-quality radios to over 100 foreign countries.

PERFORMANCE. Repco radios are built to take abuse. Rugged radios with top-of-the-line, high-performance specifications, engineered to meet your most demanding operating requirements.

RF TELEMETRY. Our emphasis on exploring the possibilities of two-way radio have made us the industry leader in RF telemetry products. For us, telemetry is more than just an "afterthought." We have off-the-shelf high-speed data modems, data repeaters, complete computer-



Now Available—
Repco's Receiver
Voting System

controlled supervisory/control systems, and *telemetry experts who can help you put radio to work in your system.*

DIVERSITY. Meet all of your RF needs with our diverse product family. Our products include—

- VHF & UHF mobiles & portables
- Repeaters
- Communications consoles
- Telemote® extenders
- Data modems
- Voting systems
- Trunked mobiles & portables
- Automatic vehicle navigation systems
- RF links (to 960 MHz)
- Data repeaters
- Base stations

Repco products. Diverse, dependable, and built to go the distance.



REPCO, INCORPORATED

2421 N. Orange Blossom Trail
Orlando, FL 32804-4806 • (407) 843-8484
Telex: 441117REPCO UI • Fax: (407) 841-0331
1-800-950-5633 (outside Florida only)

REPCO RADIO CANADA, LTD.

1060 Salk Road Unit 6
Pickering, Ontario, Canada L1W 3C5
(416) 839-5911 • Fax: (416) 839-2529

Circle (14) on Fast Fact Card

CREATING PRODUCTS THAT COMMUNICATE...QUALITY

Packet components

Each station in the packet radio network has three main components:

- ☐ **Computer**—A Commodore 64 with Com-Pakratt software.
- ☐ **Terminal node controller**—An AEA PK-232 multimode data controller.
- ☐ **Radio equipment**—Kenwood synthesized VHF amateur transceivers.

Take Your Hands Off Your Radio!



Maximize your performance with the ease and comfort of hands-free radio operation! DTC's advanced line of communication accessories are built to perform in the toughest conditions. Experience Engineering Excellence!

**DYNATECH
TACTICAL
DTC COMMUNICATIONS, INC.**

6A Lyberty Way Phone (508) 692-5434
Westford MA 01886 FAX (508) 692-9165

Toll Free 1-800-233-8639

operators trained in several ways of communicating. The county lacks enough full-time staff members to cope with the communications traffic that develops in response to emergencies. The amateur radio operators are trained to help where they are needed.

Packet radio is popular with amateurs, so it was inevitable that it should find its way into the public safety sector. It offers three advantages:

- (1) reliability.
- (2) efficiency.
- (3) ease of use.

Early commercial data communication techniques were unreliable. Data frequently were lost or, at times, a communications link could not be established.

Packet development

The growth of amateur packet radio has led to an improvement in data communication. An increasing number of amateurs devoted time to digital communications research, resulting in the development of reliable technology. Thus, equipment is available from several sources that boast fine track records.

During the years since it first was written, the AX.25 protocol used for packet radio has been refined and improved. It checks and corrects errors with a handshaking system that works with simplex and duplex radio channels. Using the AX.25 protocol, amateurs implemented the CDF communication support system with little difficulty. The system has suffered no downtime since it was activated.

Besides being reliable, the packet radio system is efficient. Each message uses a minute interval of airtime compared with the time required to send the same message by voice. Messages are routed to the correct station automatically. The communications operator does not have to monitor traffic intended for others, and manual intervention is not required.

Messages are viewed on a cathode-ray tube (CRT) display or printed to make a permanent record. Printed messages may be forwarded quickly, where voice messages first must be transcribed. This flexibility makes packet messages ideal for logistical support, such as allocating human resources, equipment and materials; creating status reports; and

NEW

ULTRALINK™

C A B L E

your best connection

Design by Cushcraft/Signals.

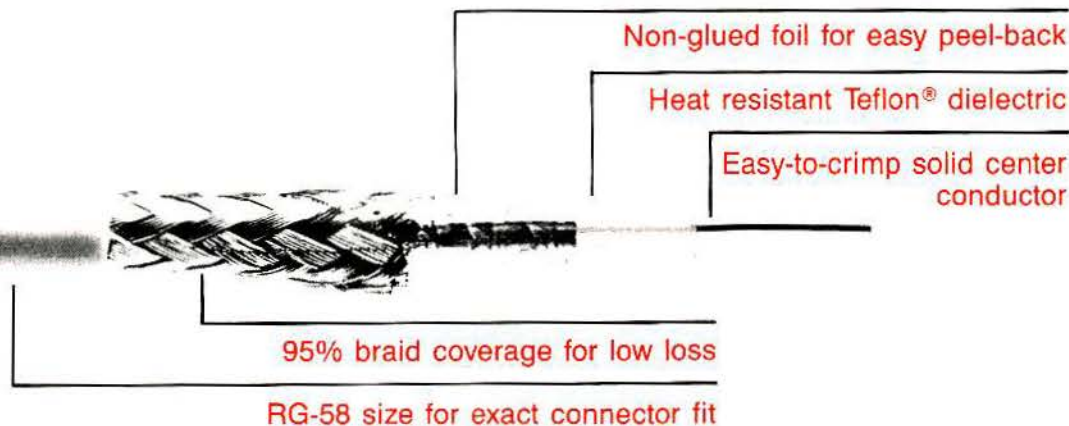
Those few words tell you that UltraLink™ was developed specifically for two-way commercial radio communication by the company that understands the need for proper cable.

Cushcraft/Signals knows the problems that installers have with cables that won't fit the connectors. We know what can happen when hot exhaust pipes contact cable. And most importantly, we know how much signal can be lost between the radio and the antenna.

UltraLink is the RG-58 size cable that withstands heat, is easy to install, and has less than 15dB loss/100 feet at 900MHz. That makes UltraLink your best connection for mobile or control station applications. And that's why UltraLink is supplied with Cushcraft/Signals 800/900MHz antennas featuring low-loss cable!

Call Cushcraft/Signals for a sample. Let your technician strip it and install a connector. You will both be convinced that UltraLink is a superior cable. That's why it carries the Cushcraft/Signals name!

1-800-258-3860



 **cushcraft / Signals**
CORPORATION

48 Perimeter Road, Manchester, NH 03108 USA
603-627-7877 FAX 603-627-1764 TLX 4949472

Circle (16) on Fast Fact Card

We've got it!

More NEW models...
Larger inventory...
Faster delivery of fine
genuine leather

Cases

that add to profits
as a companion
sale for each
new Portable.

Always in stock

Same-day
delivery on most
popular cases...
ON TIME - EVERY TIME

**BEE ELECTRONICS
INC.**

2655 Gardner Rd, Broadview, Illinois 60153
(312) 345-0337 TOLLFREE 800-336-3115

Circle (17) on Fast Fact Card



AUTOMATIC RADIO STATION CW IDENTIFIER



MODEL 813A

- MULTI-MODE OPERATION
- CHANNEL IN-USE INHIBIT
- REPLACEABLE CALLSIGN
- MINIATURE SIZE 1" x 4"
- ONE YEAR WARRANTY

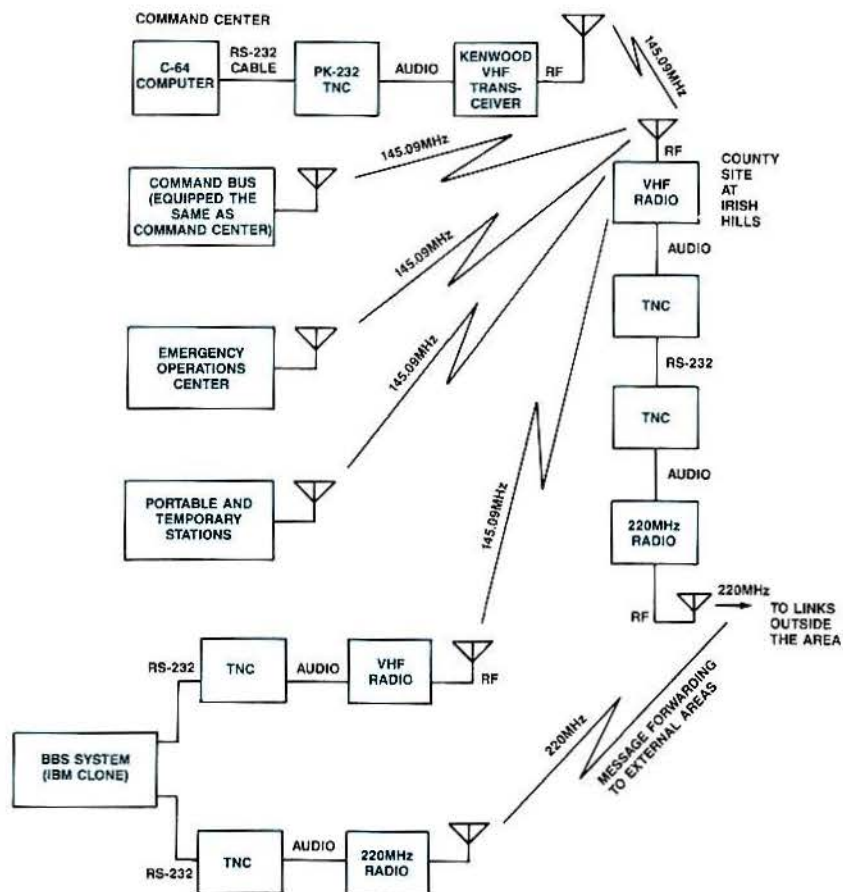
\$79.95*

*Plus Shipping, Handling & CA. Sales Tax

Securitron Co.

PO Box 32145 San Jose, Ca. 95152
Phone (408) 263-6434

Circle (18) on Fast Fact Card



The San Luis Obispo County packet system network links dispatch centers and command posts via 220MHz amateur radio. It uses the PK-232 terminal node controller TNC (pictured above) made by Advanced Electronic Applications, Lynnwood, WA.

for public relations liaison purposes.

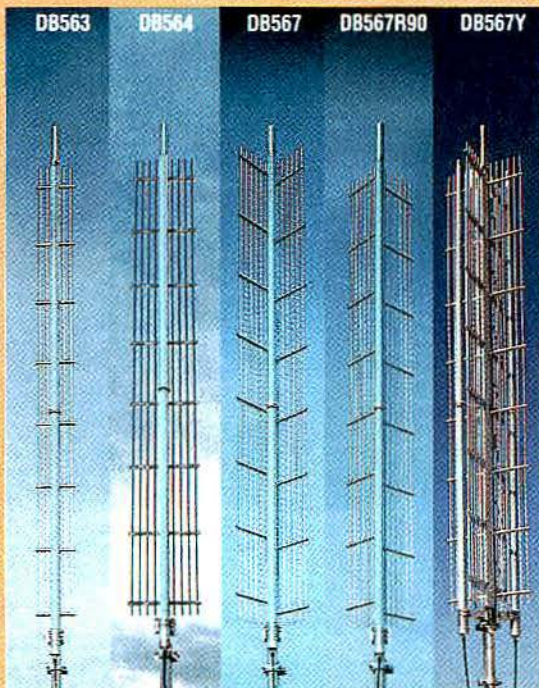
Packet radio communication equipment is easy to use. Its operation is relatively simple, and procedures are less complex than those used by organized voice communication networks.

The data transmission format can be adapted readily to accommodate an existing message form. Using packet bulletin boards allows for an ease of communication unrivaled by other modes.

Packet bulletin boards allow the packet radio user to leave a message for someone who may not be available to accept it at once. Leaving and retrieving messages saves time, especially during emergencies that stimulate a high volume of traffic.

An amateur radio bulletin board's capability exceeds that of telephone-based bulletin boards. Amateur bulletin boards can forward messages from one to another automatically. This feature is use-

Select Decibel 800/900 MHz Base Station Antennas!



Aeroglas Directionals and Omnis also offer 3°, 6° or 10° downtilt. Power input is 550 watts unless specified.

DB563 Directional (135°) Aeroglas has a 4-rod all-aluminum screen, DB562 (150°) has two rods, DB561 (170°) has the most only. 10.5 to 13 dBd gain! 806-960 MHz.

DB564 Directional (120°) Aeroglas has an 8-rod screen, provides 14 dBd gain and uses Decibel patented Center-Fed-Collinear™ (CFC™) design. 806-960 MHz.

DB567 Directional (60°) Aeroglas has a 90° open grid screen with 10 rods. Gain is 17 dBd. 806-960 MHz. CFC design assures steady beam position and good VSWR.

DB567R90 Directional (190°) Aeroglas has a reverse 90° screen with 10 rods. Gain is 10 dBd. CFC design. 806-960 MHz.

DB567Y is a dual Aeroglas directional

(60°) with 17 dBd gain and CFC design. 806-960 MHz. It has two 90° screens, each with 12 rods.

New DB580 series uses Decibel's new Horizon Blue™ Mirage™ fiberglass radomes. DB580 has 0 dBd gain, DB583 3 dBd, DB586 6 dBd and DB589 9 dBd. 806-960 MHz. Features new dual purpose top-or-side mount.

DB499 Directional Yagi, 806-960 MHz, has an enclosed feed, 20 dB front-to-back ratio and 10 dB gain. Dual model offers 13 dB gain. Heavy duty. 150 watts input.

DB834-F Directional (105°) for platform cellular sites can also be pipe-to-pipe mounted with optional kit. Gain is 10 dBd. 820-900 MHz. 525 watts input.

DB859 with 9 dBd gain and DB860 with 10 dBd gain are 806-960 MHz omnis.



Horizon Blue extruded fiberglass radomes with Minimum-Tip-Deflection (MTD™) resist winds to 125 mph (201 km/hr).

DB806TL and DB803Q are dual and quad DSD antennas in single heavy duty MTD radomes for 806-960 MHz. Duals have 6 dBd gain each, quads 3 dBd. Triples are available. 500 watts input.

DB559 is one of several Aeroglas omnis for 806-960 MHz. DB553 offers 3.5 dBd gain, DB557 7.5 dBd, DB559 9 dBd and DB560 10 dBd gain. All have CFC design.

New DB812FH inputs 1000 watts; DB812F handles 500. Both have 12 dBd gain.

DB806 with 6 dBd gain and DB809 with 9 dBd are 806-960 MHz fiberglass omnis with Dual Skirt Dipole design and up to 110 MHz bandwidth. They resist winds to 150 mph (241 km/hr). 500 watts input.

When you need 800/900 MHz antennas for conventional, trunking, paging and cellular uses, call Decibel. We offer omni, directionals, Yagis and multiples with maximum power handling (up to 1000 watts), coverage, gain and downtilt. International models available!

Decibel antenna innovations provide you many benefits and advantages.

1. New Minimum-Tip-Deflection™ fiberglass antennas handle winds to 150 mph (241 km/hr) and up to 1000 watts input power.
2. Dual-Skirt-Dipole™ design provides high gain and broad bandwidth.
3. New Horizon Blue™ Mirage™ narrow profile antenna offers top or side mount.
4. Aeroglas™, a Decibel exclusive for radomes, resists shock, vibration, winds, temperatures, and saline and caustic environments. It is so tough that it's used for Olympic vaulters' poles and for sailboat masts.
5. New dual, triple and quad multiple antennas in single radomes provide benefits where stacking is an advantage.

Wide Selection of Antennas

For cellular sites, Decibel offers configurations for platform and tower Omni-Omnis, low and high density AMPS, Omni/Sector, Sector/Sector, RSA systems and others.

For all 800/900 MHz sites, Decibel sells Aeroglas omnis with 3 to 12 dBd gain and 3°, 6° or 10° electrical downtilt (uptilt for inverted mounting). Aeroglas omnis with aluminum backscreens give directional coverage from 60° to 190° with up to 17 dBd gain, optional electrical downtilt.

HELIAX is a registered trademark of Andrew Corp.

Also offered are Yagis, solid metal corner reflectors and cylindrical parabolic antennas.

For Your Total System

Decibel offers bandpass cavities, aperture coupled bandpass filters, SHAPE FACTORED FILTERS®, passband and band reject duplexers, isolators, I.M. protection panels and Rx multicouplers for 4 to 32 channels.

New high power 2 to 20 Tx combiners handle up to 200 watts per channel, 1200 watts per 10-channel system! Also offered are mobile antennas, fiber optic systems, power amplifiers to 200 watts, Sentry 8000™ Remote Site Monitors for up to 64 Tx, and HELIAX® foam and air dielectric cables.

For more information

Contact Marketing, Decibel Products, Inc., P.O. Box 569610, Dallas, TX 75356-9610. Telephone (214) 631-0310. Telex 73-0212. FAX (214) 631-4706.

An Alliance Telecommunications Company



Decibel is the fastest growing antenna systems manufacturer in world mobile communications!

Factory Authorized Warehouses: Talley Electronics Co., Hayward CA, Santa Fe Springs CA, San Diego, CA and Phoenix AZ; CW Electronics, Denver, CO; The Antenna Farm, Overland Park KS; M. Hutton Co., Dallas TX; ComMar, Inc., Westport MA; TESCO, Inc., Hunt Valley MD and Sparks NV; Marketronics, Sunrise, FL; Primus Electronics Corp., Joliet IL; Cartwright Communications Co., Cincinnati OH, Canada: ECD, Inc., Calgary, Alberta; Niagara-on-the-Lake, Ontario; Laval, Quebec.

International: Marketronics, Sunrise FL (for South America); RAC, (Italy) Milan; Walmore Electronics, Ltd., (England) London; OmniTronics Enterprises PTE Ltd., (Singapore); Sistemas Profesionales S.A., (Mexico), Mexico City; R.F. Devices Pty., (NSW Australia) Miller.



A packet-based data communications operating center housed within the California Department of Forestry command center in San Luis Obispo (page 18) helps to carry extraordinary levels of traffic generated during high-level emergencies.

ful in getting traffic in and out of the immediate area affected by the emergency.

Network stations

The starting point for the amateur packet network used to support CDF communications is the department's Emergency Command Center (ECC). The ECC amateur station coordinates logistical and support communication.

For field use, the department dispatches a bus to the location near the incident to function as an on-site command post. The bus is equipped with another amateur packet station.

The ECC and the on-site command post are complemented by an amateur station at the county's Emergency Operations Center (EOC). The county activates the EOC when there is a countywide emergency. An accident at the Diablo Canyon nuclear power plant, for example, would be classified as a countywide emergency.

The three stations are connected with the county's extensive amateur packet repeater network, which is provided as

Tone Monitor Timekeeper™



The TK-710 monitors all 37 standard CTCSS tones on any channel. Connects to any receiver, scanner, or tone panel. Ideal for community repeaters. The TK-710 lets you find out which tones are in use before assigning a new tone. Displays tone frequency as you moni-

tor. Accumulates time and number of "hits" for each tone. Optional printer. Programmable output allows you to tape record selected user. Dealer cost \$495. Call for brochure. 1-800-521-2203

CSC CONTROL SIGNAL CORPORATION

1985 S. Depew St. #7 Denver, CO 80227 (303) 989-8000

Manufacturers of Automatic Number Identification (ANI) Systems, The Tone Monitor Timekeeper™, and Morse Code Station Identifiers.

Circle (20) on Fast Fact Card

YOU WANTED AN AFFORDABLE, HIGH-QUALITY DTMF MIC.

SHURE GIVES YOU TWO.

If you've been looking for a DTMF mic with the right combination of features and quality, at a price you can afford, Shure has the answer. Two different models designed to fit the needs and budgets of practically any user and built tough to give you the reliability you've come to expect from Shure.

NEW

885TT

QUALITY THAT'S AFFORDABLE

The new 885TT gives you an unbeatable combination of economy, dependability, audio quality, and ease of use. It's a continuous-tone DTMF microphone that sets new standards for value and performance. Features include:

- Illuminated keypad—designed to last and requiring no extra wiring in most cases.
- Million-Cycle Leaf Switch™ a Shure exclusive, giving you longer trouble-free use.
- Positive tactile-feel keys and audible tone to help make number entry easy and accurate.
- Externally adjustable audio and DTMF levels for easy installation.
- Tailored frequency response and Top-Talk Sound Channels™ provide optimum clarity and intelligibility.

890TT

THE PROGRAMMABLE CHOICE

The 890TT is a burst-mode DTMF microphone with all the features of the 885TT, plus programmable functions, including:

- Auto-dial feature has ten memory locations (up to 16 digits each).
- Last number redial.
- Lithium battery keeps the programmed memory safe for years.

BOTH FEATURE CONVENIENT, VERSATILE MODULINK™ TECHNOLOGY

Both the 885TT and the 890TT are part of Shure's patented ModuLink System 1. Modular cordsets allow them to plug instantly into over 40 radio transceivers with no hardwiring, making installations and cable replacement literally a snap.

THE FINAL WORD ABOUT QUALITY

At Shure, commitment to quality is not simply talk. You'll be able to see and feel the quality of our mics as soon as you pick one up. Because we test them tougher, our mics last longer and perform better.

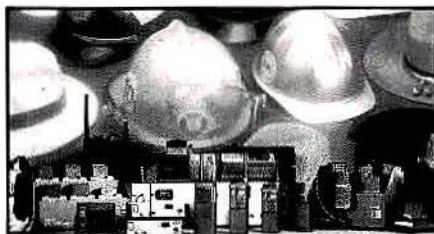
CALL 1-800-257-4873

We'll rush you a free catalog explaining, in detail, all the features and benefits of Shure DTMF mics.

SHURE®

THE SOUND OF THE PROFESSIONALS®...WORLDWIDE

Circle (21) on Fast Fact Card



Yaesu U.S.A. Manufacturer Representatives

Communications Marketing Co.
(818) 994-4455
S. CA, S. NV, HI, AZ

Proctor Sales & Marketing
(503) 657-7583
OR, WA, W. ID, W. MT, AK

Mountain Representatives
(303) 623-0972
E. MT, E. ID, WY, UT, CO, NM, W. TX

Hite Electronic Sales
(817) 483-7077
E. TX, OK, AR, LA

Ned Gordon & Associates
(612) 430-1572
ND, SD, MN, W. WI

Dick Buss Associates
(608) 987-2100
E. WI, IL

W.E. Price & Company
(517) 366-8702
MI

Capitol Electronic Sales
(317) 839-5022
IN, KY

Pro Marketing
(216) 659-3131
OH, WV, W. PA

H&M Associates
(315) 451-1588
NY (Excluding NYC and LI)

Paige Communication
(203) 537-3033
MA, VT, NH, ME, CT, RI

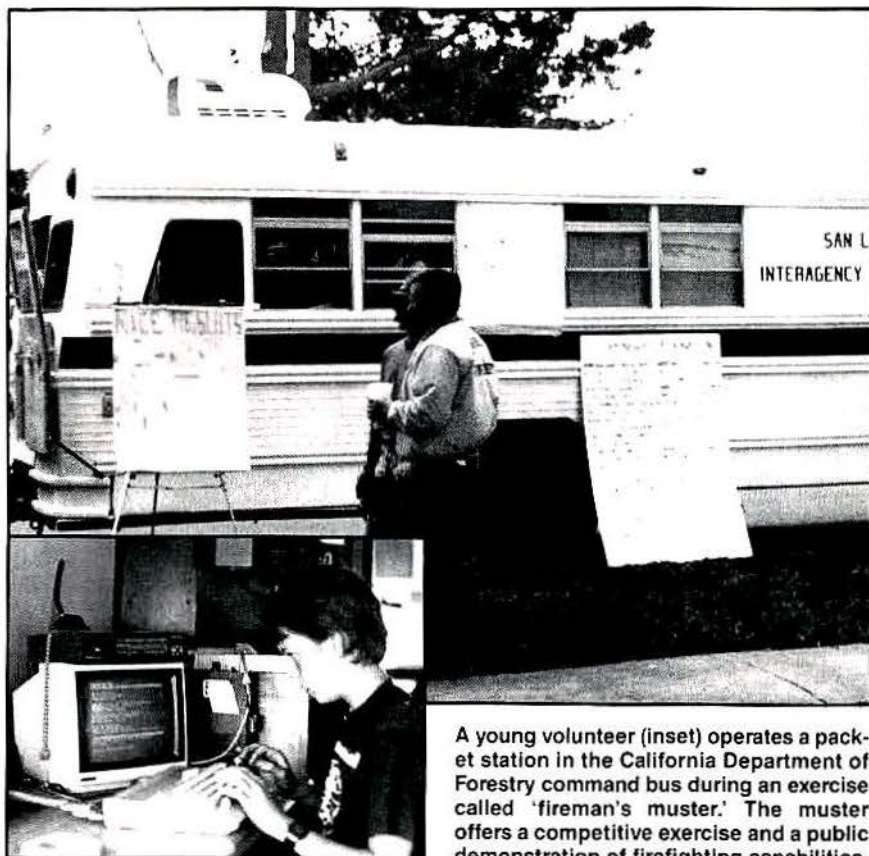
Philip M. Casciano Associates
(201) 563-0366
N. NJ, NYC, LI

All American Associates, Inc.
(301) 628-9300
E. PA, MD, DE, S. NJ, VA, DC

Mac-Com, Inc.
(305) 772-3025
FL

YAESU U.S.A.
Performance without compromise.

17210 Edwards Road Cerritos, CA 90701
© 1989 Yaesu USA



A young volunteer (inset) operates a packet station in the California Department of Forestry command bus during an exercise called 'fireman's muster.' The muster offers a competitive exercise and a public demonstration of firefighting capabilities.

a joint effort by the county government and amateur radio operators in the area. The network uses 145MHz, 220MHz and 440MHz frequencies.

220MHz reallocation

Long-distance connections with stations and networks in other areas are made on these frequencies. A reallocation by the FCC of the 220MHz frequencies is expected to have a negative effect on some of the packet operations. Although the FCC has issued the reallocation order, it has not yet ordered amateurs to cease operations, pending the establishment of a body of regulations to govern the new users on the 220MHz frequencies.

One branch of the system is the San Luis Obispo Bulletin Board System ("SLOBBS," as it is known by some amateurs). It is part of the WestNet automatic forwarding system. As such, SLOBBS can forward and receive messages worldwide. It has emergency power backup. It is configured for effective use in a large-scale emergency. Furthermore, a dedicated emergency packet radio bulletin board is slated to be configured for the county EOC.

The biggest resource offered by the amateur packet radio system that supports CDF communications comes from the population of amateur radio operators. Many amateurs are equipped with portable or regular packet stations that can be set up where needed in an emergency. These resources provide an easy way to expand the network on short notice.

Component equipment

The command center and the on-site command post use similar equipment to keep operator training requirements simple and consistent. Each station consists of three main parts: the computer, the terminal node controller (TNC) and the radio.

• **Computer**—The computers are Commodore C-64s, which use ComPakratt software developed by Advanced Electronic Applications of Kirkland, WA. The combination was selected for several reasons:

"The Commodore computer is inexpensive, efficient, and people are familiar with it," Blangsted said. "It is simple to use and meets our needs." The computers have served reliably and have

THE "A" TEAM HAS ARRIVED!

The new 2955A and 2957A radio comms test sets.

From the company that developed the world's most popular radio communications test set comes the **2955A**. It looks the same. It costs the same. It operates the same, **but inside are new features:**

- Digital Coded Squelch encode and decode
- DTMF encode and decode
- POCSAG pager testing, including alphanumeric
- Up to 33 tone sequences
- Waveform generator with Sine, Square, Sawtooth and Triangle waveforms
- Off-set level adjustment for test "cradles" or cables, couplers in the RF output
- +5dBm Signal Generator output level
- And more...

The two enhanced, independent, audio generators, along with digital modulation capability, make this test set a real powerhouse when evaluating FSK NRZ digital tone systems.

For the testing needs of the cellular industry, the **2957A** continues to offer the diagnostic power of an engineering work station while retaining user friendly, pushbutton operation for entry level technicians in the service shop.

Don't forget the most comprehensive CRT display available. Only the 2957A leaves no doubt about interrelated measurements. You view both the transmitter and receiver results simultaneously. 2957A improvements include:

- Revert to DC power supply
- Improvements in the bus structure with additional tests available.

For example, data and ST deviation measurements along with hook flash results and ST duration (timing) information, are included as standard test routines available to bus users.

What is the *real* bottom line? A *proven* cellular test set that continues to grow to meet the expanding needs of the industry.

For users who need to test cellular or trunking radios with protocols of an international structure, the new **Model 2960** offers the ability to select from up to six internally installed standards that include:

- AMPS, TACS, NMT, and RC2000 Cellular formats (variants also available).
- Band III Trunking protocol

For further details on the above products, or to join the Marconi Users Group (MUG), contact your local Marconi Representative or call direct (800) 233-2955; Fax: (201) 934-9229 or write: Marconi Instruments, Inc. 3 Pearl Court Allendale, NJ 07401 • (201) 934-9050



Captain Doug Blangsted of the California Department of Forestry operates a packet station at the judge's stand during the fireman's muster. The typical portable packet station setup (inset) includes a computer and printer.

a fine track record of service in similar applications around the country.

• *Terminal node controller*—The TNC is the heart of the packet system.

It is a device that takes data from the computer and controls the radio to send the data to its destination. According to Blangsted, the AEA PK-232 multimode

data controller was selected because his research showed it to be the unit with the best reputation.

The TNC operates at 1,200 baud, using the AX.25 level 2 protocol. The speed and protocol eliminate all errors and deliver high reliability.

The TNC has additional capabilities, including receiving weather facsimile pictures and teletype weather reports that are useful for the command center staff who must evaluate conditions that affect firefighting.

• *Radio equipment*—The TNCs are used with Kenwood VHF synthesized amateur radio transceivers. Frequency synthesis allows the transceiver to be used on multiple packet channels and voice channels when necessary.

Additional radios, including a short-wave amateur station, are scheduled to be added as the system expands. The PK-232 is suited for shortwave use and has a front-panel switch for selecting that mode.

In addition to working as operators, licensed amateurs help with the techni-

Interconnectability



Midian Electronics is proud to bring you exactly what you've been waiting for: **INTERCONNECTABILITY.** Our new DTMF encoder/decoder microphones, dash mount boxes, and modules offer you all the features you want, including connect and disconnect ANI, 10 Number Memory Dial, Last Number Redial, Busy Lockout, Time Out Timer, Dial Tone Pause, Call Routing Digit, Individual, Group, and All Call, Multiple Ring Tones, and Deadbeat Disable. Call 1-800-MIDIAN'S to find out more about Interconnectability.

To Order Call Toll Free: 1-800-MIDIAN'S

For Service Call (602) 884-7981

FAX: (602) 884-0422, Telex, 910-952-1173

MIDIAN

MIDIAN ELECTRONICS, INC. / 2302 East 22nd Street / Tucson, Arizona 85713

NEED A PHONE PATCH?



ZETRON HAS THE ANSWER

- Simplex, Half, Full Duplex
- Selective Calling—2-Tone, DTMF, CTCSS, 5/6 Tone, 2805Hz, Digital Squelch, and GE MARC™ Signalling
- ANI Recognition and Billing
- DID Option

When it comes to phone patches, we know the business. Our interconnects have all the flexible features you'd expect from the leader.

You owe it to yourself to find out why so many mobile phone systems have specified Zetron. We were first, and we're still out in front.

For the best answer to your system needs, call one of our experts. We'll put you on the right track.

To Order Call:
(206) 820-6363



Zetron, Inc., 12335-134th Ct. NE, Redmond, WA 98052
Telex: 5106010251 ZTRON SEA UQ FAX: (206) 820-7031

cal aspects of system construction and maintenance. Virtually the entire network, including the parts at the department and county offices, have been installed by amateurs. Most of the system is maintained by them.

The packet system's simplicity lends itself to decentralized maintenance that is coordinated by the San Luis Obispo County radio shop. Yet if a critical por-

tion of the system should fail, amateurs are prepared to step in with their own equipment if it is necessary to restore the system.

Organizing volunteers

When a government agency uses volunteers, attention to organization becomes important. In San Luis Obispo County, the amateurs are organized

through the Amateur Radio Emergency Service (ARES). The state forestry department has formed a special ARES group as part of its Volunteers In Prevention (VIP) program.

In addition to training and organizing

BE HEARD THROUGH THE NOISE.



When clear communication counts,

ADCO Industrial Intercoms break through the toughest problems — high ambient noise and harsh environments.

Because normal voice levels penetrate clearly, this is the perfect communication system for areas of high noise.

The system easily tolerates high temperatures and rough handling. Solid state components are protected against corrosive fumes, dirt, rain, or salt water. Each unit is sealed in a heavy-duty submergence-proof aluminum enclosure.

Special options: hands-free remote, lightning protection, extreme low temperature operation, plus many others. Easy multi-station installation.

Creating dependability since 1958, ADCO conquers noise.

Call or write for prices and complete information.

ATKINSON DYNAMICS

10 West Orange Avenue
South San Francisco, CA 94080, (415) 583-9845
A division of Guy F. Atkinson Company

Without a shout, without a doubt.

See us in
Sweet's Cat. &
Thomas Reg.

Circle (25) on Fast Fact Card

AWESOME VEHICLE REPAIR

*Can be used with most existing mobiles for inband or cross band operation.

*Compatible with most existing vehicles repeaters systems that require complicated logic functions for operation.

*Electronic hook switch disables CTCSS and stops mobile scan remotely.

\$320 user net less radios with 5 year board exchange warranty.

D&R Associates Panther Electronics

P.O. Box 3096 Peoria, IL 61614

FAX #309-691-1301 800-937-0106 309-693-0666



Circle (26) on Fast Fact Card

Advantages

Packet radio offers three advantages to public safety users:

- ☐ reliability.
- ☐ efficiency.
- ☐ ease of use.

the amateur radio operators, the VIP program conducts regular meetings to schedule projects and solve problems. Moreover, the meetings serve as social occasions to boost morale and instill a sense of teamwork among the members.

Drills and handling communications for special events keep the operators sharp. In addition, these functions introduce new amateur volunteers to the program. The participation by volunteers on the fire patrol helps to make the public more aware of fire dangers at critical times during fire season.

The payoff

The result is impressive. Emergencies are handled well, usually with resources to spare, an outcome on every emergency manager's "wish list." Routine communication tasks are simplified.

Blangsted and other VIP coordinators use the packet bulletin board system to keep in touch with other areas, such as Riverside County, that have an active amateur program. Packet bulletins from all over California provide a useful source of information about activities in various parts of the state.

One more benefit of the program is the great community relations it has developed. Because the community is involved, everyone enjoys a fine relationship. The consensus is that the amateur packet radio communications program is one they would not want to live without.



If This Looks Familiar... Take A Closer Look.



This 16 lb.* Monitor Now Does More—Even Better! **The FM/AM-500A** “Micro-Monitor” from **ifr**

From the beginning, we have always kept with our commitment to offer the highest quality, along with the best value, of any service monitor available. We are sure you will agree that the FM/AM-500A is superior to any low cost monitor on the market today...and most costing thousands of dollars more.

You asked for more features and here they are — **All Standard with the FM/AM-500A:**

- FM Signal Generator
- AM Signal Generator
- Sensitive 2 μ V Receiver for AM, FM and SSB
- ◆ 10 Hz to 9999.9 Hz Audio Generator
- ◆ Audio Frequency Error Meter
- 1 kHz Audio Generator
- ◆ Average and Peak Reading RF Wattmeter (automatically protected generator output to 150 watts)
- ◆ Frequency Error Meter with 1 Hz Resolution
- ◆ FM Deviation Meter to 60 kHz
- % AM Modulation Meter
- ◆ SINAD/Distortion Meter
- 0.5 PPM TCXO
- Audio Demodulator Output
- Microphone Input
- External 10 MHz Reference Input
- Weight: 16 lbs. (7.2 kg) approximately
*22 lbs. with optional battery
- Size: 11.5" wide, 4.9" high, 14.3" deep
(29.2 x 12.4 x 36.3cm)
- Low Price

◆ Added features

Optional Features Include:

- 0.2 PPM TCXO
- 0.05 PPM Hi-Stability Oven Oscillator (Simulcast Paging)
- Internal Rechargeable Battery (Approximately 2 hour Operation)
- High Output Amplifier (+ 30 dB Gain)
- Microphone
- ANT-2 Telescoping Antenna

Features...Performance...and Dependability...the IFR commitment. To see why we say “the best is cost effective”, contact your authorized IFR distributor in your area today for a demonstration.



IFR SYSTEMS, INC.

10200 West York Street
Wichita, Kansas 67215 U.S.A.
Phone 316/522-4981
TWX 910-741-6952
FAX 316/524-2623

Airport data system combines two-way, packet technologies

At Syracuse, NY, an airport data system combines packet sets, VHF radios and inexpensive personal computers to relay vital real-time information among airport users.

By James D. Fahnestock

Busy airports and the people who use and run them have seemingly insatiable appetites for data. The number and variety of data sources and users presents communications specialists with challenging problems.

The traditional approach to airport information distribution has involved archaic teletype equipment and the inevitable twisted pair. The Federal Aviation Administration (FAA) is replacing its system-wide "teletype" machines with new data devices using its Airport Weather Information System (AWIS), but that system handles only weather data.

Do-it-yourself advocates at the Syracuse, NY, Hancock International Airport elected to "roll their own," calling on such commonly found resources as two-way radio systems experience and personal computer involvement. The glue that holds the system together (other than its designer-builders) is packet radio hardware.

In the beginning

The project began with a much needed analysis of the problem. This study concluded that an airport data system should interconnect, for data distribution purposes, diverse users such as:

- firehouse and fire vehicles.
- airport security headquarters and vehicles.
- maintenance, including vehicles for snow removal.

Fahnestock is a writer in Ft. Collins, CO. He is a co-founder of *MRT* and was its first editor.

Definitions

ASCII: American standard code for information interchange. It describes 8-bit binary codes for alphanumeric and other characters.

HDLC: High level datalink controller. An integrated circuit serial communications controller and the part of the packet assembler-disassembler that performs the packet assembly and disassembly.

modem: modulator-demodulator. It converts digital computer signals to analog signals for transmission over analog circuits, such as radio channels and telephone lines, and recon-

verts received analog signals into digital computer signals.

PAD: packet assembler and disassembler. It breaks written messages into short segments for transmission in short bursts, reassembles messages received in short bursts and adds codes for addresses, routing and error detection.

RS-232: An Electronic Industries Association recommended standard. It defines a computer communication protocol and includes connector descriptions.

- controllers, both for aircraft and ground vehicles.
- commercial airline users at gates, ticket counters and administrative offices.
- fixed base operators handling general aviation aircraft.
- airport administrative staff, offices and vehicles.
- weather personnel.
- FAA flight service facilities.
- baggage handlers.
- Air National Guard facilities on the field.
- air freight and cargo facilities and vehicles.
- charter service operators.
- immigration and customs operations (where applicable).

Figure 1 on page 34 shows how trans-

ceivers, packet sets and telephone lines connect to form "the system." Standard, unmodified 4W Motorola MaxTrac 100 transceivers are used.

Received signals are taken directly from the 4 transceiver outputs via handset connectors, providing about 35mV to Advanced Electronic Applications PK-90 packet sets. Signals to be transmitted, and push-to-talk (PTT) control, come directly from the packet sets' outputs via the handset connector. A rear-panel adjustment varies the output level from 5mV to 100mV.

Isolation from the telephone network is provided by inexpensive 1:1 audio transformers. In the Hancock installation, one packet set is 3,000 feet from its radio set, and users report "it never misses a beat."



The NEW Glenayre team is North America's strongest paging combination.

Now your one complete source for paging equipment and voice systems is the new Glenayre team. Everything you need to service 200 to over 200,000 customers including terminals, transmitters, and voice messaging equipment. Plus all the capability you want from networking to simulcast, remote diagnostics, numeric retrieval, and more.

For rugged terminals with outstanding reliability and performance, choose from the Glenayre GL 3000 or DSS family. Advanced designs incorporating the TNPP or Digital Linking Module protocols are field-proven to be compatible with your existing equipment.

In transmitters and simulcast control systems, the undisputed leader is Glenayre-Quincy Operation (formerly Quintron Corporation). We developed the first successful simulcast systems, and continue to lead the field in sophisticated equipment design and superb field support.

A pioneer in voice messaging technology is Glenayre-Atlanta Operation (formerly BBL Industries). And the advanced architecture of the fully-featured MVP voice

messaging system utilizing Digital Signal Processing (DSP) delivers superior voice messaging performance.

That's the strongest combination of paging technology and equipment available, and it's all from the new Glenayre team. All backed by greatly expanded product service and applications engineering organizations.

Just one call to your Glenayre representative puts a whole team of paging professionals to work on serving your needs — anywhere in North America, or around the world.

Glenayre

Glenayre — Atlanta Operation (formerly BBL)	(800) 241-5240
Glenayre — Quincy Operation (formerly Quintron)	(217) 223-3225
Glenayre — Vancouver Operation	(604) 293-1611

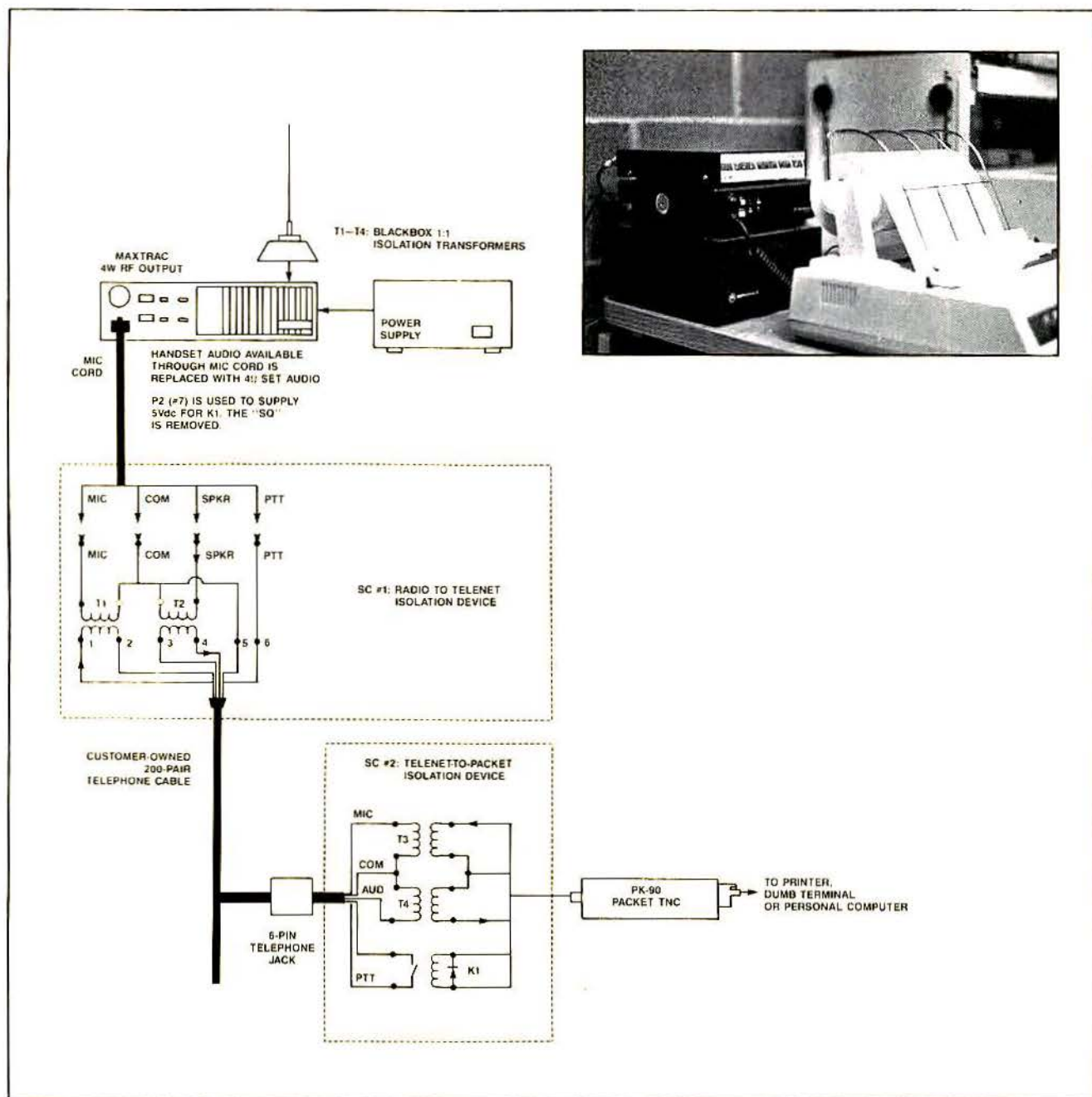


Figure 1. Telephone lines connect with two-way radios via inexpensive 1:1 audio transformer interfaces for isolation. The only connections to the transceiver are made through a standard 5-pin DIN microphone connector. The inset photo shows a receiver station. At left, top to bottom: PK-90, Maxtrac and power supply. At right is the printer.

The PK 90 packet set is an asynchronous PAD (packet assembler-disassembler) or data controller that provides all necessary data encoding, decoding and transmitter control routines needed to send and receive data using packet technology. Each PAD includes a built-in modem and HDLC system hardware to convert serial, asynchronous ASCII data (via a standard

EIA RS-232 serial port) to the internationally accepted AX.25 (half- or full-duplex) packet radio protocol.

Figure 2 on page 36 shows how typical users and groups of users are connected. A commercial product called the "Data Tap," made by B&B Electronics, is used in the RS-232 line between the PC and the packet controller to interface serial printers. In this configu-

ration, data going both ways are printed. It allows the PC to be used on another program, such as reports and other fire department activities, while "listening for" packet data. When packet data arrive, they are printed by one or more printers.

The PC's second communications port connects to the FAA's weather system via a standard 300-baud modem.

**NOW
\$5795**

Thanks For The Memories!

Sorry, but the era of the overpriced instrument has come and gone, and in its wake comes the CT Systems 3000S Service Monitor.



A full-featured Service Monitor with Spectrum Analyzer for only \$6295.

We've combined the proven reliability of our 3000B with the added advantages of our full-featured spectrum analyzer. The result... a tough, reliable, full-featured Service Monitor that, at only \$6295, delivers the best price to feature value in today's two-way market. And the 3000S is packed with standard features. Features like Spectrum Analyzer, CTCSS Tone Display, Oscilloscope, RF Sweep, FM Markers, Zero Beat, Audio Synthesizer with burst and Audio Voltmeter.

Whatever your needs, on the bench or in the field, the CT Sys-

tems 3000S Service Monitor is tough enough to provide you with years of dependable service.

Now, we could go on but we think that would be cruel. Just give us a call in the mourning, or anytime, for full specifications.

**CT SYSTEMS, INC.
5245 HORNET AVE.
P.O. BOX 470
BEECH GROVE, IN 46107-0470
800-245-6356
317-787-5721**

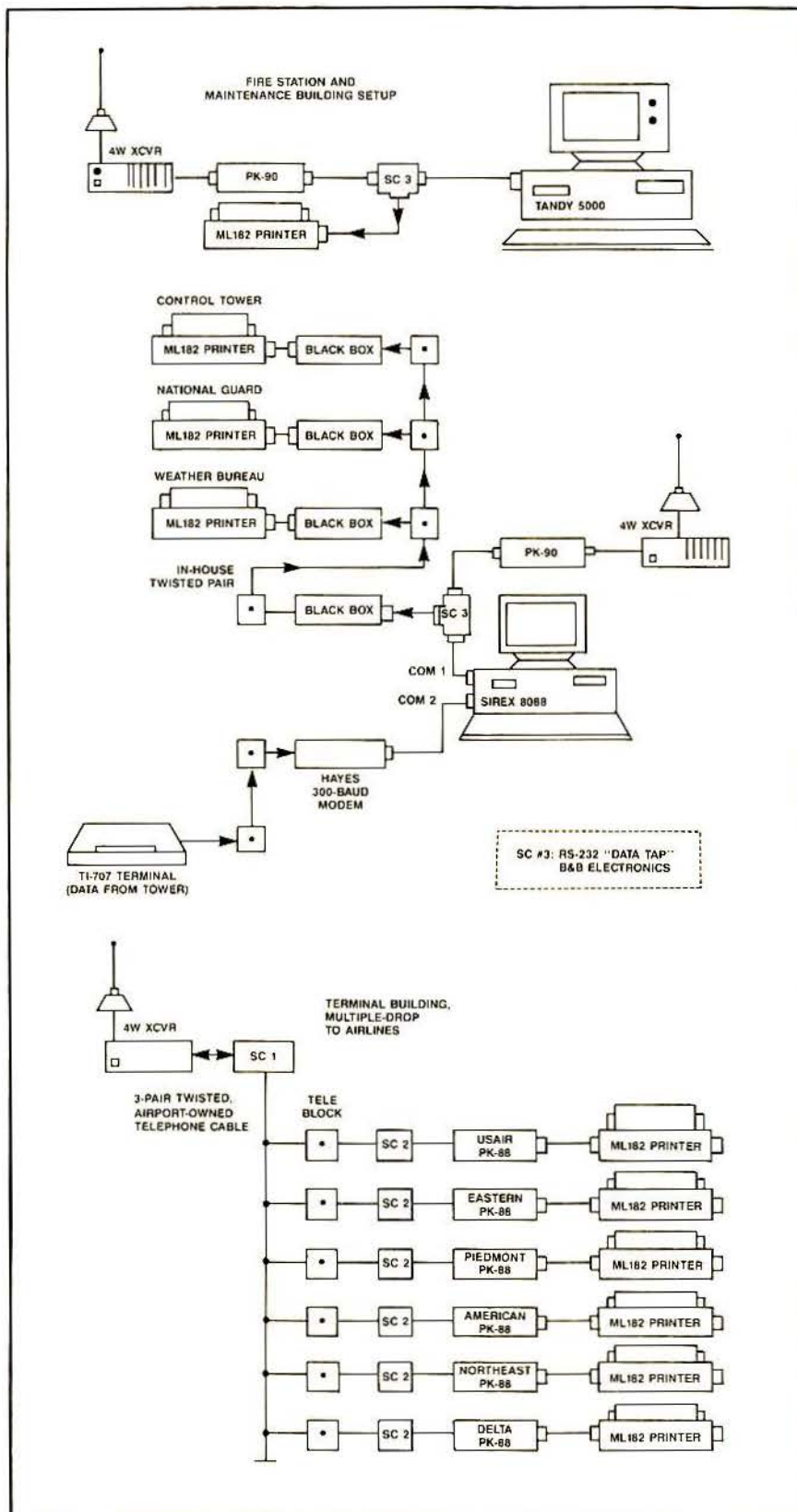


Figure 2. Airport data users are interconnected by a combination of radiolinks and twisted-pair links. One VHF transceiver services all six commercial airline gates. The fire station and maintenance facilities have their own radiolinks and computers.

(FAA systems use a Texas Instruments TI-707 "dumb" terminal, made "smart" by a proprietary cartridge that Hancock employees report costs \$100, but the cartridges are available only in quantities of 100 or more.) A simple PC program was written to perform the same function.

Radiolinks were used where appropriate, with some distances exceeding 5 miles, feeding telephone line links where feasible, for further distribution. The typical users shown in Figure 2 have receive-only terminals, but two-way radios are needed for the handshaking necessary to ensure accurate data transmission according to packet protocol.

The Hancock system is being implemented in phases. The first phase, accommodating essentially those facilities indicated in Figure 2, has been operating since late 1988. Results have been excellent, according to airport authorities.

Future phases call for equipping airport vehicles with two-way terminal systems. Mobile data terminals will enable, for example, fire officers to call up data on airport (or other) buildings for information such as occupant data, emergency phone numbers and the presence of hazardous materials.

One special feature of Hancock's approach is that connected personal computers still are available for normal PC functions, such as record keeping, materials management and other typical PC jobs. Though data that flow via the radio-twisted pair network are vital to airport operations, only a small portion of the computers' data-handling capabilities is required for that function.

A not-too-apparent feature of the Hancock system is the ability to communicate privately when radio security is necessary or desirable. According to some system users, every newsroom in central New York monitors the airport's VHF radio frequency. There are times, they say, when communicating is preferable to broadcasting. Moreover, the system gives airport officials the opportunity to communicate with selected units or all units simultaneously.

Figure 3 on page 38 shows two typical messages. The encryption is for brevity rather than security, with extreme abbreviations that have been in



4 reasons Midland LMR is second to none.

1. Complete Product Line. Over 100 models of mobiles, portables, base/repeaters, and CMS/trunking, with all the options and accessories you need. Midland meets your needs with everything from basic crystal portables to powerful Midland Syn-Tech™ technology.

2. Superb Dealer Network. Over 600 experienced communications professionals nationwide. Carefully chosen to understand your communications needs. Someone you can count on locally for system planning, fast delivery, financing/leasing, licensing assistance, and responsive service.

3. Reliability. Every Midland LMR radio meets or exceeds industry standards. Each individual radio must pass stringent, multi-stage, computer-aided QC testing — and we put it in writing. A computer printout of its final performance check goes right into the carton.

Circle (30) on Fast Fact Card

With Midland, you get communications you can count on to perform — even in severe environmental conditions.

4. Value. It's that rare combination of quality, performance and reliability — at reasonable cost. Supported by factory experts and local Midland dealers who make your satisfaction top priority. It's built Midland into a position that's second to none in land mobile radio. And it can make you a confident radio buyer.



See how Midland and your Midland dealer meet your 2-way radio needs in our "Intelligent Choice" brochure. For your copy, call:

1/800-MIDLAND

(ext. 1690)

MIDLAND LMR
LAND MOBILE RADIO

The smartest way to get ultra-high performance in 2-way mobile radio. Now with advanced, greatly simplified software that makes operator access to superior Syn-Tech II capabilities even easier. Plus a wide array of options to fit your needs exactly. All in compact units, remarkably simple to use, flexible, and affordable.



Up to 320 channels, programmable in up to 16 groups; operator selectable and assignable. Wideband. Built-in programmable CTCSS/DCS, DTMF ANI, burst-tone encode, 2805 Hz decode, channel scanning with dual priority, TOT and BCLO.



Syn-Tech™ II. It's "simply" superior.

Programmable switch/indicator functions, plus a wide choice of "custom" control panel configurations. Options include signaling, full duplex capability, "Private Squelch," voice storage, and vehicular repeater.



Syn-Tech II ruggedness is just as outstanding. Die-cast chassis to meet/exceed MIL 810C/D for shock and vibration. Optional MIL 810C/D salt-fog, dust, and rain protection.

Midland LMR. The smart way to go

© 1989, Midland International Corporation



(A)

(B)



BUY THE AMT-2 AND GIVE CELLULAR A RUN FOR ITS MONEY.

Here's the Hark solution you've been asking for: the AMT-2 Mobile Telephone Terminal. Now, your in-place IMTS systems and conventional RCC mobiles can offer the full-featured flexibility of cellular phones.

The AMT-2 allows system owners to customize every subscriber's service -- individually. Even those

"cellular" features like call forwarding, call waiting and speed dialing. There's a call tallying package, too, that's compatible with most billing software.

Let the competition promote all the benefits and features they want. Add Hark's AMT-2 and you'll have the low cost alternative to keep cellular on the run.

For more information, call (803) 747-2988 or dial 1-800-FOR HARK.

HARK

Hark Electronic Systems, Inc.
6296 Rivers Avenue, Suite 310
North Charleston, SC 29418

FIND YOUR OWN HARK SOLUTION CALL: 1 • 800 • FOR • HARK.

Circle (32) on Fast Fact Card

pressure is 1024.4 millibars (244), temperature and dew point are 76°F and 60°F, respectively (76/60). Surface wind is from 320° at 5 knots (3205) and the altimeter setting is 30.25 (025). The first digit of pressure numbers always is omitted. Pilots "fill in" the implied numbers.

Sparkplugs of the Hancock system were Tim Huppmann, chief of the air-

port's fire-rescue crew, and Robert "Beau" Blair, a personal computer hobbyist and a member of the fire-rescue department.

The Hancock approach shows how custom performance can be obtained from judicious application of off-the-shelf two-way radios, commercial packet controllers, readily available personal computer hardware—and people.

Packet primer

Packet technology is invading the two-way radio industry. (See "Packet Radio Combines Computer, RF Technologies" in the August and September 1985 issues.) Inexpensive packet controllers provide turnkey interfaces between two-way radios and data devices such as terminals, computers and printers.

Normally, no hardware modification is required of either the radio or the data device. Interconnection is made via existing ports, such as the handset plug of the radio.

Data to be transmitted are routed to the radio via the packet controller, which bundles the data together and housekeeping information (including the "address" of the desired destination device or devices) and applies the resulting packets to the radio's input as a burst of what sounds like noise. Packet controllers have their own built-in modems.

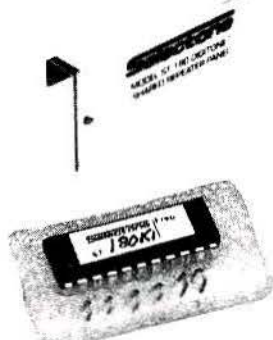
The sending controller does not stop there. It begins accumulating data for the next packet and begins looking for an acknowledgement (ACK) of the one just sent. If it does not receive the ACK within a preset interval, it sends that packet again. Additionally, it maintains constant watch for incoming packets from any other device in the system.

At the receiving end, an identical packet controller receives the packet, including the data and housekeeping information. If the data have arrived precisely as transmitted, the controller sends an ACK to the source and the data to their terminal, computer or printer.

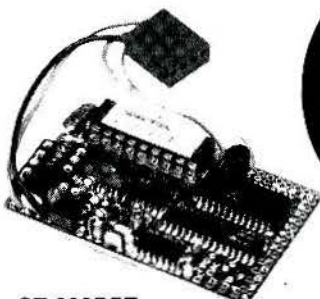
More than 100 commands are available for programming packet controllers via their respective data devices. By these commands, the system's packet controllers can be customized for optimum performance. The PK-90s used in the Syracuse system can be programmed remotely via telephone lines, radiolinks or both, giving the system manager the opportunity to reconfigure the system without visiting each site.

"NO FRILLS" REPEATER PANEL

ST-180
Shared Repeater Panel



ST-180K1 Tone
Module Kit



ST-800RPT
Remote Control Module (optional)

- **Digitally Programmable** – to any of 37 RS-220A CTCSS frequencies plus 97.4 Hz.
- **Busy Channel Lock-out** – to prevent a different user from capturing repeater during drop-out delay.
- **Remote ON/OFF (Optional)** – allows repeater owner to remotely shut off non-paying customers.
- **Tone Translation** – allows re-transmission of a different CTCSS tone than the one received.
- **Low Current Drain** – draws less than 60 mA stand-by at 13.6 Vdc \pm 20%.
- **Easy to Install** – only 6 connections are required for most repeater applications.

\$229.00

Dealer Net w/one
tone channel installed

FOR FULL FACTS, CALL TOLL FREE (800) 227-0376

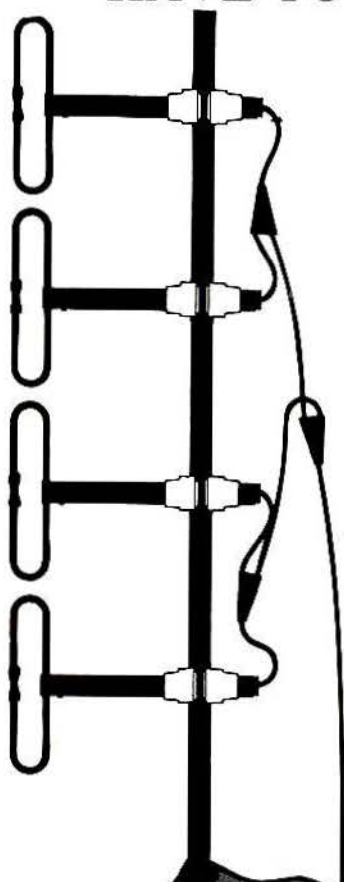
Selectone

23278 Bernhardt St., Hayward, CA 94545
[415] 887-1950 • FAX [415] 887-4011

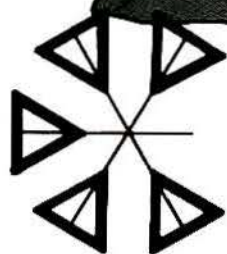
Circle (33) on Fast Fact Card

TELEWAVE ANTENNAS

HAVE YOU EVER SEEN A MILLENNIUM SEAL?



The Land Mobile Communication industry recognizes the open dipole base station antenna, with a direct feed to each element, as the most versatile and efficient gain antenna available. Why doesn't everyone use this type of antenna? The answer is obvious; DURABILITY. The antennas supplied by major manufacturers of Open Dipole Antennas to the communications market today, have one common fault. After a short period of time, contaminants leak into the cable harness junctions and destroy the performance of the antenna. Finally, the problem has been solved by Telewave's new MILLENNIUM-SEAL™. This space-age compound forms a permanent protective bond on the cable junctions that long outlasts all previous protective methods. Using our new MILLENNIUM-SEAL™ enhances the time proven design and by the application of our black epoxy coating over the alodined aluminum surface sets a new standard for the communications industry. Telewave is a full line supplier of all types of antenna systems, including end fed fiber glass, and yagi antennas. We also offer a full compliment of communications cables and connectors for land mobile and microwave that meet every installation requirement.



TELEWAVE, INC.



1155 TERRA BELLA, MOUNTAIN VIEW, CALIFORNIA 94043

(415) 968-4400 • TWX 910-3795055

Circle (34) on Fast Fact Card

Integrated system controller improves trunked SMR systems

Integrating previously isolated trunked repeater functions into single system controllers improves interconnection and makes computer management easier and more flexible. The equipment costs less and is easier to install.

By Jim Bonnicksen
and Larry Bess

Integrated trunked SMR system controllers take "add-on" functions and put them into one box. (See Figure 1 at the right.) The integration pays dividends in the form of extra features and cost savings made possible by single microprocessor control.

For years, adding trunked system features such as telephone interconnection, airtime accumulation, validation and modem control often has required adding many components to each repeater. Add-on microprocessor-based interconnect and repeater controller products made for conventional systems have tended to be consolidated into single units. Trunked repeater components have joined that trend.

Integrated system controllers cost less and are easier to manage than diverse components.

History

In 1976, FCC action in Docket 18262 reassigned UHF-TV channel 70 to 83 frequencies for land mobile radio systems. The federal agency then assigned some of the frequencies to a new "specialized mobile radio" service—businesses that sell radio communication service to others. The FCC defines SMR as: "a radio service in which licensees provide land mobile communications services in the 800MHz and 900MHz bands on a commercial basis

Bonnicksen is the writer and technical editor of the Zetron "Advantage" newsletter. Bess is sales manager of the Mobile Systems Division at Zetron, Redmond, WA.

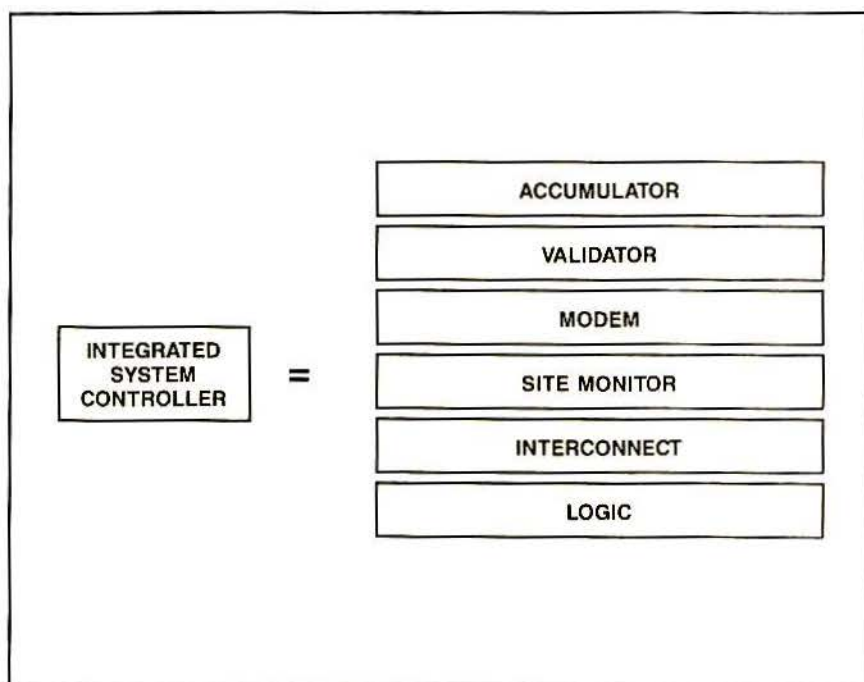


Figure 1. An integrated system controller replaces several modules used in a Uniden or Johnson LTR trunking system.

to entities eligible to be licensed under the part [of the private radio regulations], federal government entities and individuals."

The word "specialized" differentiates these frequency bands from previously established land mobile bands at 30MHz, 150MHz and 450MHz. SMR service opened the door for entrepreneurs to provide dispatch radio service on a paid basis to customers. Many of the newcomers could not obtain spectrum in the lower bands or afford licensing fees and financing required to become a regulated radio common carrier (RCC).

The FCC set aside channels for conventional (single-channel) two-way radio dispatch and cellular mobile telephone. In addition, 200 frequency pairs were set aside for trunked systems, and more have been added since.

The FCC defines a trunked radio system as: "a method of operation in which a number of radio frequency channel pairs are assigned to mobile and base stations in the system for use as a trunked group." It means users' radios automatically select an open channel from a pool of channels. With single-channel systems, when the one channel is busy, there is no opportunity to use

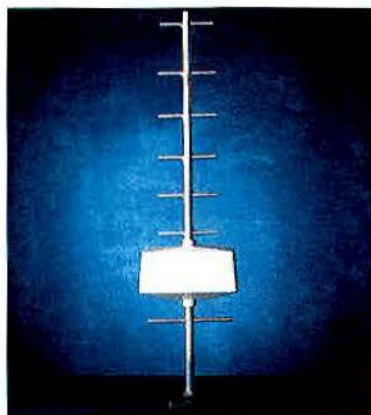
CELWAVE Quality:



Road tested tough.

It isn't likely the top of your transmitter tower will ever be subjected to heavy vehicular traffic, but Celwave actually ran over the radome of its new PD10108 Yagi antenna just to see how rugged it really is.

How rugged is it? Rugged enough to get run over and come out undamaged. Rugged enough to be part of an 806-960 MHz antenna specifically designed for control station operation with director and reflector elements of solid 6061-T6 aluminum rod precision welded to eliminate misalignment problems during shipping, installation and service. You can't get more rugged than that.



The radome completely encloses the active element eliminating pattern distortions caused by

icing or heavy rain. This true 10 dB Yagi (E.I.A. Standard 329) has a VSWR under 1.5:1 for a bandwidth exceeding 80 MHz. The small surface area of the PD10108 antenna minimizes wind resistance and conserves tower loading capacity while providing heavy duty coverage.

Altogether, the PD10108 Yagi gives Celwave a very tough to overcome advantage in customizing solutions to your antenna site problems. At the very top, the very bottom and everywhere in between.

CELWAVE, Route 79, Marlboro, NJ 07746. Tel 201-462-1880. Telex 4944313 CEL NJ.

CELWAVE



a nearby channel that might be open, so communications efficiency suffers.

To trunk multiple channels together, a system controller or multiple system controllers at the multiple-repeater site coordinates and controls mobile unit frequencies. Automatic channel selection reduces waiting time for an open channel and increases channel capacity for a given service quality. Service quality usually is defined as waiting time—the lower the waiting time, the higher the service quality.

Several manufacturers make trunked systems, using different signaling protocols to control the mobile frequencies. So many system operators chose E. F. Johnson Clearchannel LTR (logic trunked radio) equipment that other manufacturers found it expedient to develop mobile units and trunking controllers that function with LTR signaling. The proliferation of LTR and LTR-compatible systems and mobile units has made LTR the *de facto* SMR trunking standard.

In LTR systems, repeaters and mobile

radios transfer control information via data packets without voice communication interference by using audio frequen-

*The proliferation of LTR
and LTR-compatible
systems and mobile units
has made LTR the de
facto SMR trunking
standard.*

cies below 150Hz. Two-way radio voice frequencies only reach as low as 300Hz.

Microprocessors and programmable read-only memories (PROMs) in mobile units encode and interpret data

packets. So does similar circuitry in each repeater's system controller (also called "logic module"). A coaxial cable data bus connects system controllers to convey repeater "busy" or "free" indications.

Cellular mobile telephone competition spurs SMR operators to add telephone interconnect. Increased interconnect traffic leads to the use of airtime accumulation and billing. Thus, add-on components have proliferated, including validators, call accumulators, remote programming units, interconnects and interconnect enhancements, such as direct-inward-dialing (DID) converters.

Problems

These extra components gave SMR operators tools to compete with cellular carriers. But introducing separate components into a trunked system has its problems:

- (1) Wiring and installation may be difficult, especially with components from different manufacturers.
- (2) It costs more to make stand-alone

```
Last Msg# 6 Mail: TRUCK6 TRUCK1 S.JONES SYSOP ALL
cmd: C PGBBS
[AEA-C1.512-6]
Welcome to PG/BBS, Portland Generation Co., Portland OR
5 msgs - Last # 6.
Type <ENTER> for general HELP information
Type <letter><ENTER> for HELP with the following commands:
PGBBS 1747 UTC (B,D,H,I,J,K,L,N,R,S,T,U,V,W,X,Y,Z) >
RM

05:50:41 PM
Date: 16 AUG 89 17:25:04 Z
From: DISF@PGBBS
To: TRUCK6
Subject: Job #3465
When you finish there, go to 1234 Main street and install the 30
KW transformer you will find there in circuit 34. John/Dispatch
B
*** Disconnected PGBBS
CMD: Last Msg# 6 Mail: TRUCK1 S.JONES SYSOP ALL
```

BBS-90 E-MAIL For AEA Packet Radio

Eliminate "phone tag" with Packet radio.

Eliminate "phone tag" forever with AEA's new BBS-90 Packet Radio Electronic Mail System. Using your Packet radio station, simply send your message to a third-party Packet station running the BBS-90 computer program in its PC. It will store your message or file, and periodically send a traffic-waiting notification to the intended recipient's station. You may even instruct the BBS-90 station to forward the traffic through other BBS-90 stations to a BBS-90 station within radio-range of the recipient. Or you may run a program such as a

database application at the destination location and obtain results from it.

AEA offers a variety of Packet, RTTY, SITOR and facsimile Data Communications products for under \$500. Ask about AEA's PK-90 or PK-232 Data Controllers and communications software programs for PC and Macintosh computers.

Advanced Electronic Applications, Inc.

2006-196th St. SW/P.O. Box 2160

Lynnwood, WA 98036

Tel: (206) 775-7373 FAX: (206) 775-2340

Telex: 6972496 AEA INTL UW

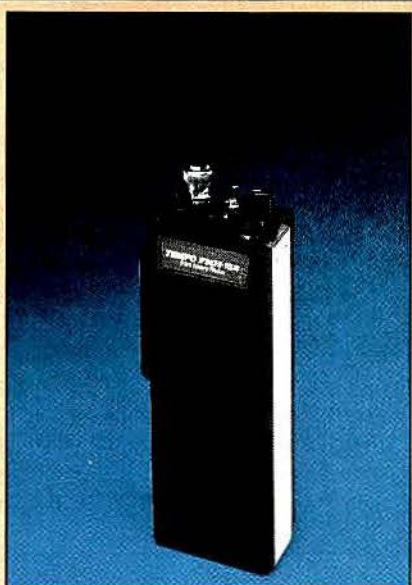


IN-STOCK FOR IMMEDIATE SHIPPING

Tempo™ Hand-Held Radios

Versatile, dependable local communications! Tempo FM business band portables save time and money in providing local communications. Eliminate errors, speed deliveries and improve productivity with instant person-to-person communications.

Hand-helds are perfect for security, construction, agribusiness, warehousing, marine operations, ski patrol, airlines, fire and police and hundreds of other applications. *Full line of accessories.*



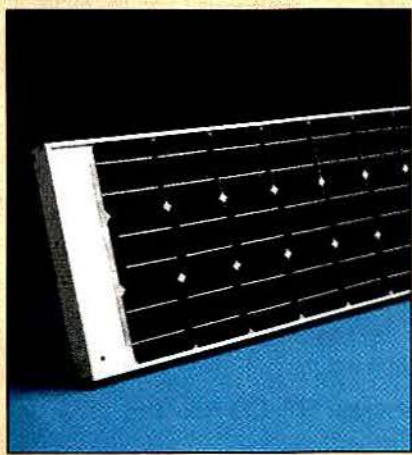
Tempo™ Mobile Radios

Economical, reliable mobile transceivers are available for immediate shipment. Several models offer a choice of features to the two-way customer. Type accepted for all business and public safety uses.



Hoxan™ Photovoltaic Products

The reliability of Hoxan solar products is backed by a 10 year guarantee. True quality that lets you enjoy complete independence from utility lines or fuel storage tanks. Completely modular units can add or subtract from a system easily. Reliability, independence, modularity, economy, safety. Henry Radio is your best choice for communications power.



Bird™ Wattmeter

For your convenience, we maintain a large inventory of Bird Wattmeters, elements, loads, and accessories for immediate delivery. Contact us for all your Bird equipment needs.



HENRY RADIO

Over a half-century of reliability in communications.

2050 S. Bundy Drive, Los Angeles, CA 90025; toll free: 1-800-877-7979; FAX: 1-213-826-7790

Also in stock: ASTRON Power Supplies, CUSHCRAFT Antennas, LARSEN Antennas, MAXCOM Antenna Tuners, PIPO Touchtone Pads, MAG INSTRUMENTS Flashlights plus much more two-way and amateur radio equipment and supplies.

Circle (37) on Fast Fact Card

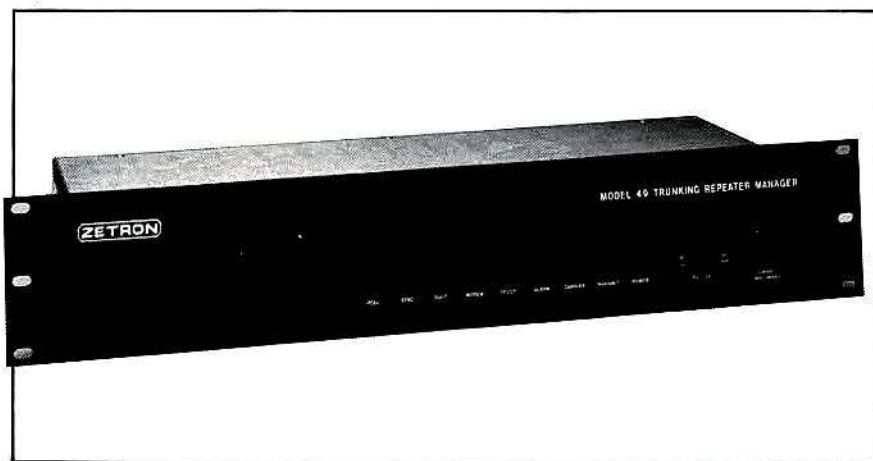


Photo 1. Zetron's model 49 integrated LTR system controller.

hardware. Thus, a combination of components carries a higher price than an integrated unit that performs the same functions.

(3) Separating functions into different modules limits how well and how efficiently separate circuit boards interact. Interconnect features especially are limited because modular system design

requires costly converters for microwave or DID (selector-level) service.

Improvements

For years, interconnects and dispatch controllers have been made for conventional, single-channel repeater systems. As microprocessors improved the technology, interconnect and controller units

became remotely programmable and boasted built-in features, such as airtime accumulators. Then products with combined interconnects and dispatch controllers appeared. Today, integrated system controllers are available for trunked repeater systems.

Photo 1 at the left shows a production model controller that combines LTR logic circuitry, interconnect, accumulator, validator, modem and site monitor. Other functions beyond the reach of separate add-on circuitry are made available through the single, integrated microprocessor control. One controller is needed for each channel.

The controller is compatible with Johnson and Uniden high-speed data buses. In addition, it connects with any radio repeater compatible with digitally coded squelch.

Software management

Multisite, multichannel management system software is made possible by the integrated configuration. Using an office PC, an SMR owner can manage the

STRIKE UP THE BROADBAND

STI-CO's custom disguised VHF broadband antennas cover the *entire* frequency range of 150-174 MHz.

Our cellular style VHF broadband antennas cover that range and *also the 806-896 MHz band.*

Now, STI-CO proudly introduces cellular elevated feed style UHF broadband antennas. *They cover 20 MHz within the 406-512 MHz frequency range!*

When it comes to covering frequencies, STI-CO has the best broadband in the land.

STI-CO
INDUSTRIES, INC.

36 LETCHWORTH STREET BUFFALO, NEW YORK 14213 (716) 881-3287

Circle (38) on Fast Fact Card



This is the future of RF communications testing



Enter options via software.

Only the 4031 STABLOCK™ has the flexibility, functionality and expandability that you need to meet tomorrow's RF testing needs as well as today's:

- ☐ Multiple options via software — upgrades are easy
- ☐ Memory card Test Setup storage
- ☐ Memory card Auto Run test programs
- ☐ Multiple analog and digital displays
- ☐ Standard U.S. and European formats
- ☐ Built-in prompts and Help features
- ☐ High Resolution Zoom Graphics
- ☐ 22 test instruments in one
- ☐ 1000 MHz spectrum analyzer
- ☐ 1 db combiner test
- ☐ Cellular test

Call us today to see the future in action — the 4031 STABLOCK Test Set, 1-800-225-5765 in MA (617) 229-4825.

**Schlumberger Technologies
Instruments Division**

Schlumberger Technologies

STABLOCK is a trademark of Schlumberger Technologies, Inc.

Schlumberger Instruments
20 North Avenue
Burlington, MA 01803, USA
Phone — 617-229-2548
1-800-225-5765

Schlumberger Instruments
Victoria Road
Farnborough, Hampshire
GU14 7PW, England
Phone — 0252-544433

Schlumberger Instruments
50 Avenue
Jean Jaures, BP 620-06
92542 Montreuil Cedex, France
Phone — 1-47-466700

Schlumberger Messgeräte GmbH
Ingolstädter Str. 67a
8000 München 46
West Germany
Phone — 089-318890

Circle (39) on Fast Fact Card

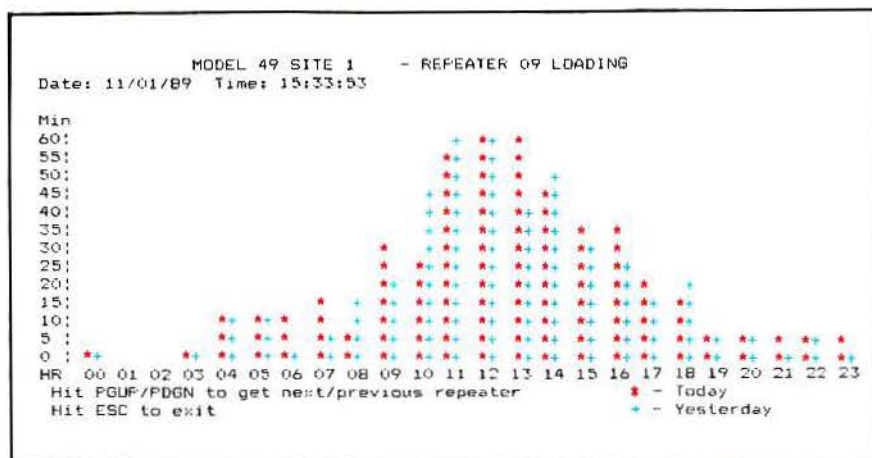


Figure 2. A copyrighted bar chart compares traffic loading from day to day.

site, repeater and subscriber databases. One phone call to each site retrieves air-time and interconnect information via a built-in modem in the integrated controller.

Changing interconnect or dispatch mode settings involves no separate procedures—all programming takes place from the same program. Adapt-

ing the system to customers' changing needs only requires using the office computer. When one repeater controller is reprogrammed, it automatically updates others at a site via a subscriber data bus.

Telephone interconnect

An interconnect-equipped system

controller compatible with all types of incoming telephone lines offers broad capabilities.

For example, direct-inward-dialing (DID, or selector-level service) capability allows the use of DID telephone lines assigned not one seven-digit phone number, but a block of numbers. Block assignments allow each mobile radio to be reached at a unique telephone number—just like cellular telephones. A caller does not have to "overdial" extra codes to reach an SMR mobile telephone user. An integrated system controller with DID capability on the interconnect circuit saves the cost of external DID converters.

A built-in E&M Type I four-wire interface on an integrated trunking system controller allows the repeater's site's incoming telephone connection to be made via microwave link, as is required at some mountaintop sites that lack wired phone service. An E&M interface places calls faster because it bypasses DID conversion circuitry. E&M interfaces use fewer phone lines because an

ONE MOBILE RF AMP THAT WON'T DIE IN THE LINE OF DUTY.

SHURE SMARTAMP™—THE FIRST COST-EFFECTIVE MOBILE RF AMPLIFIER SMART ENOUGH TO PROTECT ITSELF. Intelligence sets SmartAMP apart. It's constantly analyzing and monitoring three crucial operating conditions: VSWR, temperature and input power. When SmartAMP detects a danger condition, it shuts itself down. Avoiding any damage. But the operator remains "on the air"—operating at transmitter output power.

SHURE SMARTAMP SHUTS ITSELF OFF—TURNS ITSELF BACK ON. SmartAMP continues to monitor operating conditions even after it has shut itself down. And as soon as conditions again allow for safe operation, SmartAMP automatically resets itself to deliver rated output power.

8 RELIABLE MODELS TO CHOOSE FROM. SmartAMP comes in 8 different models—4 UHF and 4 VHF—designed to meet most requested land mobile frequency ranges.

SHURE SMARTAMP COMES WITH AN UNBEATABLE WARRANTY. Each SmartAMP comes backed by a limited one year warranty, covering all components—even the final RF power transistors.

ANOTHER QUALITY PRODUCT FROM SHURE. Like all Shure products, SmartAMP will perform to specifications—if not exceed them.

CALL TOLL-FREE 1-800-257-4873 (In Illinois call 1-800-624-8522) for more information on the Shure SmartAMP. Or return the coupon below.



YES, please send me your free brochure.

SmartAMP™

Name _____
Title _____
Company _____
City _____ State _____ Zip _____
Phone _____

SHURE

Dept. 1563, 222 Hartrey Ave.
Evanston, IL 60202-3696

MR010S

Circle (40) on Fast Fact Card

Now with dual protocol

Double duty.

Only one manufacturer is on speaking terms with both EF Johnson and Motorola 800 MHz trunking systems: Standard Communications.

Standard's new high tech GX Series mobile radios are the only ones that allow you to "roam" between trunking systems. Our dual protocol capability means that you can operate off the Motorola Privacy Plus® or EF Johnson LTR® System that gives you the best coverage in your area with the simple push of a button.

And the GX Series offers features like automatic interconnect to dramatically simplify telephone access, and audible notifications to alert the operator when a dispatch or interconnect system becomes available.

In short, the Standard GX Series radios give you a full complement of easy-to-use features, the benefit of a choice between Motorola or Johnson 800 MHz trunking systems, Standard's high quality products and competitive prices.

To get the full story on the complete line of Standard trunking radios, contact Standard or your nearby Standard Dealer today.

The business radio people.

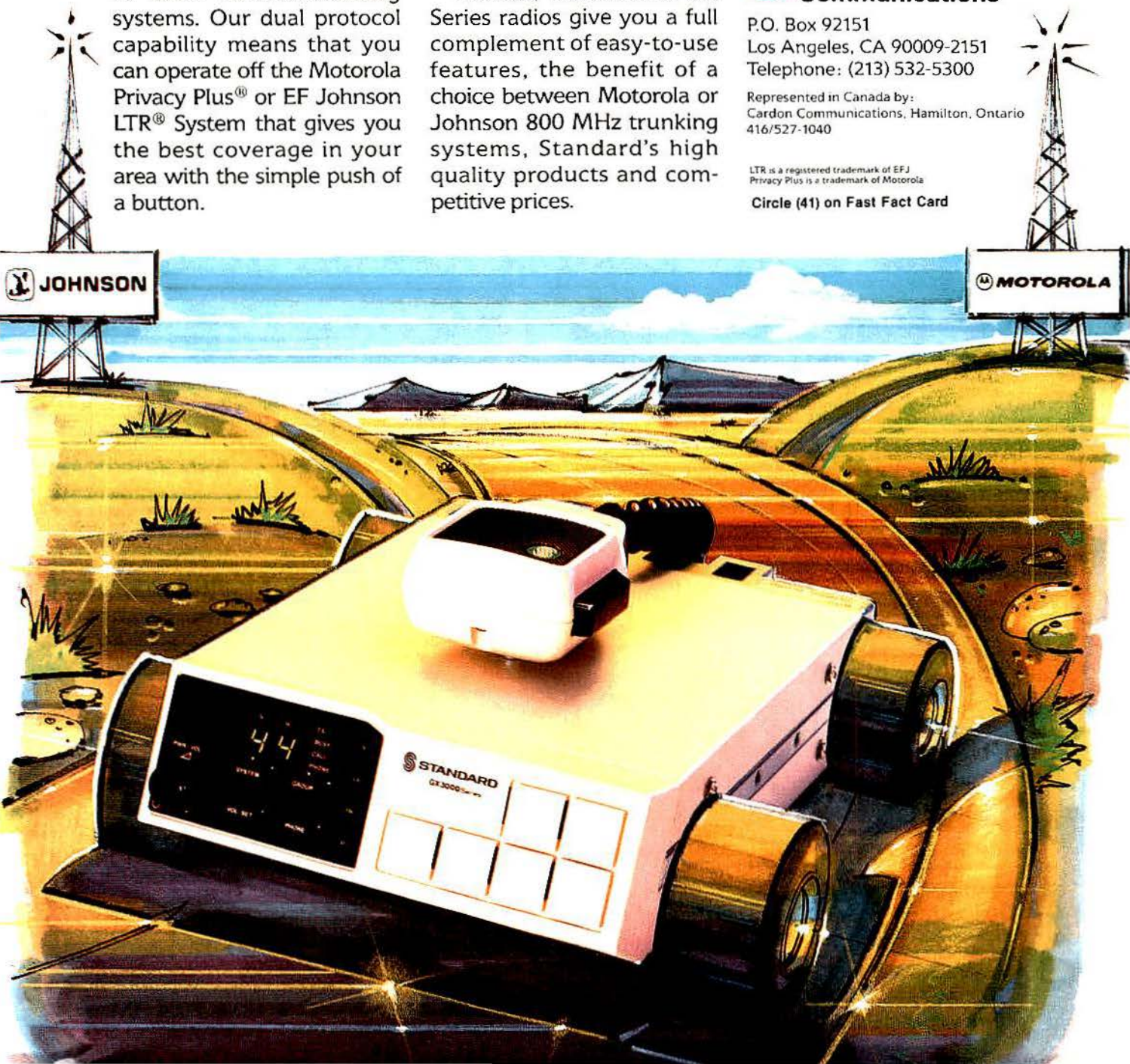
 **Standard
Communications**

P.O. Box 92151
Los Angeles, CA 90009-2151
Telephone: (213) 532-5300

Represented in Canada by:
Cardon Communications, Hamilton, Ontario
416/527-1040

LTR is a registered trademark of EFJ
Privacy Plus is a trademark of Motorola

Circle (41) on Fast Fact Card



MODEL 49 SITE 1 - REAL-TIME MONITORING									
Date: 11/01/89 Time: 15:35:19									
RPTR #	HH-UUU	T	SECS	RPTR #	T	SECS			
01	01-020	D	00017	11	-				
02	-			12	-				
03	-			13	13-070	D	00031		
04	-			14	-				
05	05-143	I	00107	15	-				
06	-			16	-				
07	-			17	07-117	I	00177		
08	-			18	-				
09	09-106			19	-				
10	01-111	D	00009	20	-				

Figure 3. A copyrighted monitor display shows traffic loading as it occurs. HH-UUU indicates the home repeater number and the user's ID code. Under the 'T' column, D = dispatch call; I = interconnect. The SECS column records conversation length.

E&M circuit is two-way; each DID circuit requires an additional direct-outward dial (DOD) line to become two-way. An advantage of microwave connections is the elimination of a hybrid circuit that may reduce voice quality.

Adaptive call limiting

Adaptive interconnect call limiting al-

lows an SMR operator to provide interconnect service without adversely affecting dispatch traffic. A software program defines interconnect traffic restrictions that vary with system traffic loading. (See Figure 2 on page 48 and Figure 3 above.) Interconnect call lengths may be limited. So may the number of repeaters simultaneously

used for interconnect calls.

Limits are set with the help of a computer screen display. The operator fills in a system traffic loading table and applies different restrictions for various loading levels, such as 20%, 40% and so forth. Different restrictions can be set for high- and low-priority customers. The programming is loaded into the controller via a dial-up telephone line. The system controller calculates the loading percentage moment by moment and applies the corresponding restrictions.

Adaptive interconnect call limiting allows interconnect installation on all repeaters. Software settings ensure repeaters always are available for dispatch use, no matter how many users attempt interconnect calls. As traffic eases, so do the interconnect restrictions. Call limiting allows interconnects to be used to the fullest extent without degrading dispatch service—an important factor for SMR operators whose dispatch service is the greatest source of revenue.

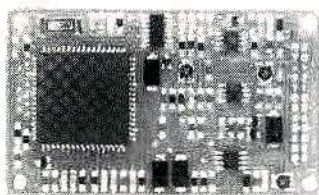


GLB HIGH SPEED RADIO MODEM

The Model HSM-5 is a low-cost OEM subassembly for high speed two-way synchronous data communications via radio.

APPLICATIONS:

- TELEMETRY
- MONITORING
- REMOTE CONTROL
- ROBOTICS
- POINT-OF-SALE TERMINALS



FEATURES:

- 9600 AND 4800 BAUD DATA RATES
- UTILIZES FSK ON STANDARD VOICE CHANNELS
- COMPATIBLE WITH MOST VOICE AND DATA RADIOS: DIRECT FM, SYNTHESIZED & PHASE MODULATED
- LOW CURRENT DRAIN PLUS POWER-DOWN MODE
- ON-BOARD WATCHDOG TIMER
- FAST DCD OUTPUT FOR QUICK TURNAROUND TIME
- COMPATIBLE WITH MOST PACKET CONTROLLERS
- SMALL SIZE
- WEIGHS ONLY ONE OUNCE

Custom versions of the Model HSM-5 can be supplied for volume applications requiring smaller size, lower current drain, or wider operating temperature range.

SPECIALIZING IN RF & DIGITAL COMMUNICATIONS DESIGN & MANUFACTURING

GLB ELECTRONICS, INC.

151 Commerce Pkwy., Buffalo, NY 14224
Phone 716-675-6740 FAX 716-675-6742

Circle (42) on Fast Fact Card

COMMUNICATIONS IS THE GAME. WE HELP YOU KEEP SCORE.

Developed specifically for the communications service professional, Computer Resources' system allows your business to operate at peak performance. Not only full service accounting but specialized packages for service management, RCC billing and invoicing, SMR billing, and Sales Management. We provide a total package including hardware, software, installation and training.

Call today for a FREE brochure.

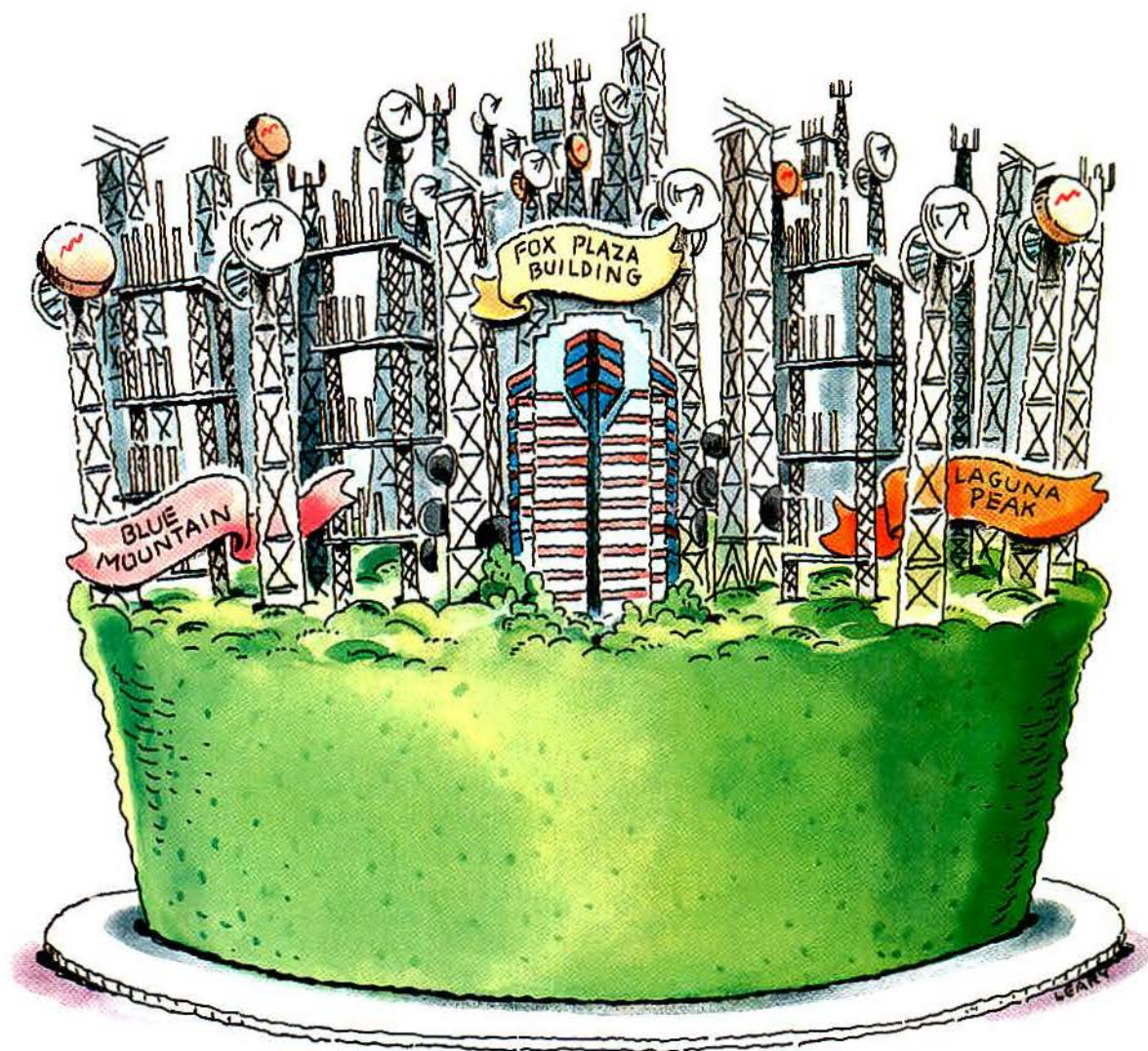
computer resources inc.

101 39th STREET NORTH
BIRMINGHAM, ALABAMA 35222
(205) 591-8810

10



Circle (43) on Fast Fact Card



We're 31.

Even though we've been in the communications business thirty-three years, we're celebrating 31 this year. That's because we've grown bigger and stronger—adding three new antenna sites to our existing 28.

As a result of going to great lengths to satisfy our customers, we cover Southern California like no other company—from the Mexican border to Santa Barbara.

Our newest antenna site atop the Fox Plaza Tower Building in Century City offers coverage of southwestern Los Angeles.

Our new site at Blue Mountain covers San Bernardino, Riverside and the Moreno Valley. And our other new site at Laguna Peak covers the Oxnard, Ventura and Camarillo areas.

More Power With A More Personal Touch. In serving our customers' diverse needs, we offer secure facilities and standby power, as well as community repeater and trunking capabilities.

And while we grow larger and more powerful year after year, we'll never lose that personal touch thanks to the hands-on involvement of Rich and Jack Reichler.

LOCATION	N. LATITUDE	W. LONGITUDE	A.M.S.L.
Fox Plaza Tower Building	34° 03' 19"	118° 24' 44"	300' (bldg. 501')
Blue Mountain	34° 01' 20"	117° 17' 46"	2428'
Laguna Peak	34° 06' 37"	119° 03' 49"	1300'



Meridian Communications

23501 Park Sorrento, Suite 213A, Calabasas, CA 91302-1355 • (818) 888-7000

Circle (44) on Fast Fact Card

Index to 1989 features



Alternative energy

"Pick Alternative Energy for Remote Radio Sites," *Diana Bjornskov*, Onsite Energy, October, page 10.

Amplifiers

"Why Tower Top Amps Improve Reception," *Ernest N. Mann*, Central Maine Power, April, page 44.

Antennas

"Repeater Antenna Selection and Maintenance," *Roald Steen*, September, page 26.

"Helical Antennas Replace Lowband Quarterwave Whips," *Don Bishop*, editorial director, September, page 38.

"Antenna Tester Checks Two-Way, Cellular SWR," *Robert L. Davis*, Datronics, November, page 70.

Batteries

"NiCd Battery Charging Takes Only 3½ Minutes," *Don Bishop*, editorial director, February, page 22.

"Getting the Best Charge From Your NiCd Batteries," *Bob Williams*, Alexander Manufacturing, February, page 30.

Buyers' Guide

"1990 Buyers' Guide," *staff report*, December, page 8.

12 Product Directory

86 Services Directory

90 Company Addresses

132 FCC Offices Directory

133 Trade Associations Directory

Cellular

"Antenna Tester Checks Two-Way, Cellular SWR," *Robert L. Davis*, Datronics, November, page 70.

Coaxial cable

"Use Coaxial Cable To Communicate Where Antennas Cannot Go," *Udo Bode*, Cablewave Systems, April, page 10.

Communications consoles

"Planning To Move Your Dispatch Center," *Herb Sachs*, editorial

advisory board, March, page 88.

"Dispatch Consoles Are Communications Integrators," *Paul McGee*, Motorola Communications Sector, July, Page 10.

Data, mobile

"Designing and Implementing Automatic Vehicle Location," *Dan Perlstein*, department of ambulance services, municipality of Toronto, and *Mario Cid Fernandez*, Nav-Com, January, page 12.

"How Small Agencies Can Use Mobile Data Communications," *Mary M. Peters*, Hadron, January, page 54.

"How To Correct Errors in Mobile Data Transmission," *Peter F. Driessen*, Datawave Communications, January, page 60.

Encryption and scrambling

"A Rolling Code Scrambler Gathers Diverse Functions," *E.J. McKernan*, Midian Electronics, and *Bill Scott*, Comm-Tech, July, page 42.

Fiber optics

"Replace Coaxial Cable With Optical Fiber," *Don Bishop*, editorial director, February, page 8.

"Fiber Optics Serve Mobile Radio Systems," *Roald Steen*, February, page 12.

"Fiber Optics Cut Noise in Vehicle-Mounted Radios," *Don Bishop*, editorial director, February, page 18.

"Technical Considerations for Vehicular Fiber Optic Links," *John Freed*, Teletec, March, page 24.

Frequency Coordination

"Frequency Coordinators Work To Speed Service, Cut Costs," *Don Bishop*, editorial director, February, page 36.

Installation, maintenance and repair

"Base Station Feedline Performance Testing," *Harold Kinley*, CET, South Carolina Forestry Commission, April, page 20.

When every second counts...



Count on the reliability and performance of communications consoles from Orbakom

In an emergency, reliable communications are the lifeline for survival. That's why so many communications systems rely on Orbakom's CALIDA and TDM-150 consoles. Their superior performance and solid dependability have been proven in the most demanding applications.

If you need the control flexibility of a big console on a small budget, CALIDA is for you. CALIDA handles 16 channels, includes a multi-format paging and signalling encoder, is completely user programmable, and features a 12/24 hour clock, VU meter, alert tone, crosspatch, service intercom, desk mic with PTT and monitor switches, surge protection, and a wealth of other professional features.

If your service requires a state-of-the-art dispatch console, Orbakom's TDM-150 is the solution. TDM-150 is a custom system, so we'll configure it the way you need it — up to 120 channels or more and 120 positions. TDM-150 uses time-

division multiplex (TDM) digital audio processing and complete microprocessor control. Operation is simple and menu-driven. Reliability is ensured through surge protection, self-healing diagnostics, and battery backup. Eight levels of multi-channel radio and telephone patch may be run simultaneously, and an internal paging signalling encoder generates any sequence you'll ever need. Plus the best two-year console warranty in the business.



CALIDA: Big console flexibility for smaller systems



TDM-150: Our state-of-the-art, 120+ channel console

Take your pick. CALIDA for professional performance in smaller systems. And TDM-150 for state-of-the-art performance on 120 channels or more. Either way you can count on Orbakom. Our communications consoles are the most reliable you can buy, and have been since 1970.

Call (609) 829-4455
and let Orbakom solve your
dispatching problems. Orbakom
Systems, Inc., 1704 Taylors Lane,
Cinnaminson, NJ 08077;
FAX: (609) 829-6980.



**ORBAKOM
SYSTEMS, INC.**

Circle (76) on Fast Fact Card

"Installing Mobile Radios: Tips From the Field," *R. Scott Gilmore*, Saginaw County, MI, Department of Communication Engineering, April, page 95.

"Performance Testing for Base Remote Controls," *Harold Kinley*, CET, South Carolina Forestry Commission, May, page 44.

"Frequency Synthesizers: How They Work," *Harold Kinley*, CET, South Carolina Forestry Commission, June, page 10.

"Frequency Synthesizers: Troubleshooting Techniques," *Harold Kinley*, CET, South Carolina Forestry Commission, July, page 20.

"Use Digitized Terrain Data To Plan a Repeater Site," *Michael Wiebe, P.E.*, and *Larry D. Ellis, P.E.*, SoftWright, August, page 10.

"Getting the Most from Your SINAD Meter," *Harold Kinley*, CET, South Carolina Forestry Commission, August, page 38.

"Simple Calibration for Deviation Measurements," *Paul C. Bunnell*, engineering consultant, August, page 48.

"Repeater Antenna Selection and Maintenance," *Roald Steen*, September, page 26.

"Swersweep: A New Method of Measuring SWR," *Joe Peterzak*, Europa Marketing, October, page 64.

"How To Repair Mobile Radios," *Roald Steen*, November, page 10.

"Soldering and Desoldering: Proven Workbench Methods," *James Bausell*, Pace, November, page 20.

"RF/IF Signal-Tracing and Gain Measurements," *Harold Kinley*, CET, South Carolina Forestry Commission, November, page 54.

"Antenna Tester Checks Two-Way, Cellular SWR," *Robert L. Davis*, Datronics, November, page 70.

Interference

"How To Avoid FCC Violation Notices," *Don Bishop*, editorial director, April, page 84.

"Use Direction-Finding To Trace Interference," *Joseph D. Moell, P.E.*, Hughes Aircraft, October, page 18.

"Radio Direction-Finders from \$125 to \$350,000," *Don Bishop*, editorial director, October, page 34.

"Why Undesired Propagation Causes Radio Interference," *Roald Steen*, October, page 76.

Lightning protection

"Lightning Sparks Debate: *Prevention or Protection?*" *Don Bishop*, editorial director, January, page 40.

Meteor-scatter radio

"Tracking 64,000 Vehicles with Meteor-Scatter Radio," *Kathy Mickelson*, editorial assistant, January, page 24.

Microwave

"Use Short-Haul Microwave in Land Mobile Systems," *Jim Screeden* and *Dave Babbitt*, Motorola Communications Sector, May, page 24.

Modems

"Radio Modems Replace Leased Telephone Lines," *Judi Kanne*, March, page 20.

Paging

"What's the Range of my Pager?" *Jim Hathaway* and *Roy Holmes*, Reach Electronics, May, page 10.

"Networking Protocol Links Voice Paging Systems," *Don Arnold*, Commonwealth Communications Industries, May, page 32.

"Paging Coverage vs. Frequency," *Jim Hathaway* and *Roy Holmes*,

THE SWITCH IS ON...

When it comes to product quality, selection, and after sales support, nobody but nobody can match our commitment to excellence. And it's paying off with something we think you care about . . . customer satisfaction.

Dealers across the country have come to depend on IDA products for operating flexibility, easy installation, crisp clean audio, and day after day reliability. From DTMF hand mics and control heads, to DC and tone remotes, conventional and trunking interconnects, and air-time billing packages, IDA offers a complete line of products guaranteed to keep your customers in operation.

If you've been looking for products you can sell with confidence, find out why mobile radio professionals have switched to IDA. Call us today at 800-843-2197 or 701-280-1122.

IDA

1100 S. 32nd Ave. • Moorhead, Minnesota 56560



Reach Electronics, June, page 48.

"Modular Design Delivers 'Flexible' Paging Terminal," *Timothy D. Minter*, Unipage, September, page 46.

Product Preview

"Product Preview," *staff report*, May, page 81.

Public-safety communications

"Modify Code 3 Equipment for Public Safety Use," *B.A. "Duke" Ducote*, City of Richardson, TX, March, page 92.

"APCO National Conference Preview/Guide," *staff report*, July, page 60.

"APCO Wrap-Up/Review," *staff report*, October, page 55.

Repeaters

"Repeater Mod Combines Tone and Digital Squelch," *Rod Wheeler*, The Radio Shop, April, page 80.

"Use Digitized Terrain Data To Plan a Repeater Site," *Michael Wiebe, P.E.*, and *Larry D. Ellis, P.E.*, SoftWright, August, page 10.

"Universal Vehicular Repeater Extends Portable Range," *Wes Sutton*, Magnum, August, page 30.

"Repeater Antenna Selection and Maintenance," *Ronald Steen*, September, page 26.

Salary Survey

"1989 Salary Survey," *Jane Bryant*, staff editor, September, page 10.

Signaling

"Repeater Mod Combines Tone and Digital Squelch," *Rod Wheeler*, The Radio Shop, April, page 80.

"Why System Operators Choose DTMF Signaling," *Eliot Terborgh*, Selectone, November, page 38.

Simulcasting

"Telephone Technology Solves Radio Simulcast Problem," *John Downing*, Fresno County, CA, telecommunications engineer, April, Page 64.

Towers

"When To Use Strobes on Communications Towers," *Don Bishop*, editorial director, March, page 10.

"Why Tower Amps Improve Reception," *Ernest N. Mann*, Central Maine Power, April, page 44.

Trade show coverage

"IMCE Show Preview/Guide," *staff report*, March, page 32.

"Telocator Spring International Convention," *staff report*, April, page 76.

"Convention Speakers See Glowing Future for Mobile Communications," *Jane Bryant*, staff editor, June, page 32.

"ENTELEC '89 Conference Boasts 30 Technical Papers," *Don Bishop*, editorial director, June, page 40.

"APCO National Conference Preview/Guide," *staff report*, July, page 60.

"Expo/East Preshow Overview," *staff report*, August, page 50.

"Telocator 41st Annual Convention & Exposition," *staff report*, September, page 54.

"APCO Wrap-Up/Review," *staff report*, October, page 55.

"Future Technology Unfolds at Telocator Convention," *Don Bishop*, editorial director, December, page 134.



**channel
elements**

ICM can install new crystals in your elements. We can supply reconditioned elements for most communications equipment.

Crystals are installed, compensated, and tested at ICM. All elements will meet or exceed stability requirements in the equipment for which they were designed.

**Just tell us what you need
call TOLL FREE 1-800 426-9825**

ICM
**INTERNATIONAL CRYSTAL
MANUFACTURING CO., INC.**

For your information ...

About MRT

Mobile Radio Technology is the journal of mobile communications technology. Our goal every month is to present technical and factual information that you immediately apply to your working life.

Business, Editorial offices

Direct all subscription, advertising, circulation and editorial inquiries to P.O. Box 12901, Overland Park, KS 66212; phone: 913-888-4664; fax: 913-541-6697.

Sales offices

East: Ruth Breashears, 303-762-1249.
West: Dennis Hegg, 415-491-1442. Midwest: Diane Hite, 303-762-1249. Classified: Carla Gamino, 303-762-1249. Associate Publisher/National Sales Manager: Mercy Contreras, 303-762-1249.

Subscription information

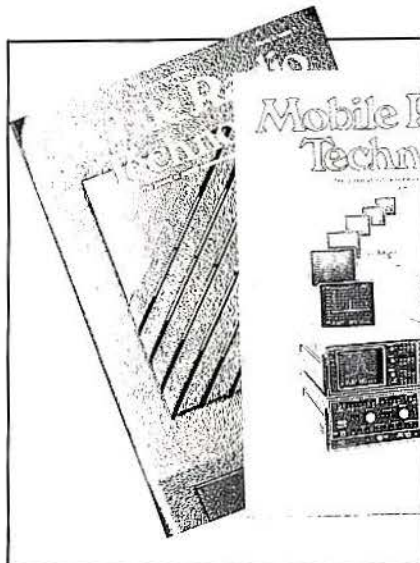
MRT is distributed free to qualified subscribers. Others may subscribe for \$30 per year in the United States; \$36 per year in Canada; and \$40 per year in other countries. To subscribe, fill out the subscription card that is printed in red and included in every issue. For more information, contact the circulation department in Overland Park.

Back issues

A limited supply of back issues is available for \$3 each plus postage and handling. Contact the circulation department for more information.

Writing for MRT

This is your magazine and we encourage you to submit articles. Prospective contributors should not feel intimidated. It is best to submit a written query before you submit an article. A copy of authors' guidelines is available; direct all queries to Don Bishop, Editorial Director, in the Overland Park office.



News release guidelines

We welcome news releases from all industry participants. We reserve the right to make the final determination as to what is appropriate for the readership. We also reserve the right to edit releases for length and clarity. Send releases to the Overland Park office.

Please do not call to see whether we have received your release. We receive hundreds of releases each week and it is impossible to track each one. Allow two to three months from the time you send the release in to when it appears in print. If it has not appeared in print within this timeframe, resubmit the release.

Black and white photos are appropriate to send along with news, people and new product items.

Departments for which you may want to include releases include:

News—events or developments of interest to the entire industry.

New Products—the latest product introductions, service offerings, hardware and software updates, and product upgrades.

Literature—the latest brochures, catalogs and publications.

People—promotions and company changes in the industry. Also special recognition awards.

Calendar—An up-to-date listing of upcoming trade shows and industry conferences.

Letters

We welcome letters to the editor on any topic of importance to the industry. Letters must be signed and are subject to editing for length and clarity. Unless otherwise stated, all letters received will be considered for publication. Send letters to the editorial office in Overland Park.

What Do You Think?

This questionnaire covers important topics in mobile radio, and we want your opinion. Complete the questionnaire bound in the back of each issue and return it to Overland Park. We pay the postage and the results to the questionnaires are printed in the "Feedback" department.

Corrections

We make every effort to make sure everything we print is accurate. Nevertheless, clarifications and corrections sometimes are needed. Corrections are published on the letters pages. Please let us know when something is incorrect. Contact the Overland Park office for more information.

Where did you hear about our product? Service?

When asking dealers, manufacturers and consultants about products and services, particularly when doing business with them, please mention *MRT* as your information source. Advertisers run their advertisements because they want to reach you, the readers. Help complete the circle by telling them you saw their ad or first read about their product or service in *MRT*.

Your requests for more information on new products serve as a "voting" method for the most popular products printed in a particular issue. These products are designated as "Readers' Choice" items and are reprinted in an

upcoming issue, so be sure to "vote" by returning the Fast Facts Card in every issue.

Special issues

For your convenience and information, we prepare special pre-show issues that are designed to help you to plan your itinerary at trade shows. These sections vary in coverage from overview of main items of interest to a complete show "map" of events, including exhibit hours, seminar topics and schedules, list of exhibitors complete with booth numbers and an exhibit hall floor map. Also a list of existing product and services and new product and services slated for display is included. Be sure to circle Fast Fact numbers on the Fast Fact Card in the back of the issue to receive more information on the products that will be on exhibit.

Editorial Quality Review Board

MRT has an Editorial Quality Review Board made up of readers who evaluate articles and issues for six months. The board examines editorial quality, timeliness, pertinence to industry, graphic quality and appeal, and usefulness. Board membership changes every six months. If you would like to be considered for an appointment to this board, send your name, title, company name, address and phone number to Don Bishop, Editorial Director, in the Overland Park office.

Fast Fact Card

Please use the Fast Fact Card, published in every issue, for the most con-



venient way to get more information concerning an ad, a new product, literature item or other editorial item. We process all inquiries three times a week, so your inquiry goes to the manufacturer on a timely basis. If you have a problem in getting information, contact the manufacturer directly.



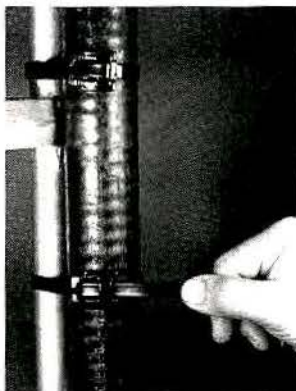
If You Had Used BAND-IT E.V.A. Stainless Steel Cable Ties You Could Have Stayed On The Ground Today

... and tomorrow and next week ... The fact is, once you've bundled cable with BAND-IT E.V.A. Stainless Steel Cable Ties, it **stays** bundled.

and weather extremes. Won't crack or get brittle.

EASY TO APPLY — unique fastening system locks with a flick of the wrist.

BAND-IT E.V.A. Cable Ties are made from high strength, corrosion resistant 316 stainless steel coated with Ethylene-Vinyl Alcohol copolymer. Check these features and then call your local distributor or BAND-IT for complete information and a sample.



SAFE — non-toxic, halogen free, fire resistant E.V.A. coating prevents damage to cable or interference from direct contact with stainless steel.

REUSABLE — fast and easy to unfasten and refasten.

VERSATILE — available in wide combination of colors, lengths and widths for any application.

PERMANENT — non-corrosive, unaffected by UV



BAND-IT®
THE CLAMPING EXPERTS

BAND-IT — IDEX, INC.
A Unit of IDEX Corporation
P.O. Box 16307
Denver, CO 80216-0307 U.S.A.
(303) 320-4555 Telex 45-0009
FAX 303-333-6549



Circle (46) on Fast Fact Card

FAA lightning test: Scientific or not?

Are Federal Aviation Administration (FAA) tests of lightning prevention equipment at its Orlando and Tampa, FL, airport communications facilities scientific or not? The answer seems important to everyone concerned with the tests—except the FAA.

"These are not scientific tests," said John Garry, FAA technical program manager of tower systems, who oversees the test project. "These tests are only comparative and visual. The only thing scientific about it is demagnetization of tape and looking at a flashbulb to see whether it has been triggered." An open flashbulb filament indicates new lightning has struck; the magnetic tape measures current flow through a conductor connecting multipointed air terminals to ground.

"We are not measuring very scientifically, just in the event something happens how much current was on the downconductor," Garry said.

Although the FAA seems uncon-

cerned whether the tests are scientific, supporters and critics alike are fixated on the point. Supporters of lightning prevention technology hope the FAA tests show lightning prevention devices work and the word "scientific" can be attached to the results. Critics are poised to attack results that look positive if the tests are not scientific. Critics further believe results of scientific tests would be negative. Exactly what position either side will be left with if results are positive and the FAA does not assert scientific validity is uncertain.

Thus, one supporter has been moved to claim more for the FAA tests than the agency itself does. Donald F. Hudalla, president of Lightning Deterrent, Chicago, flatly states that "the monitoring program of the FAA in this instance conforms to scientific method." Lightning Deterrent distributes one of the two brands of equipment undergoing testing.

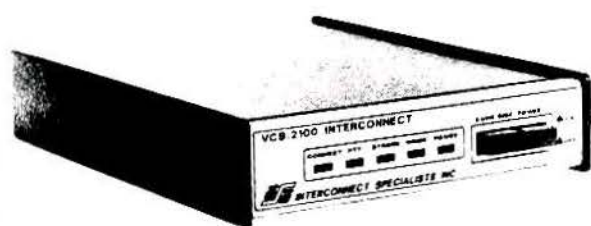
Another supporter has been moved to cite positive test results, maybe prema-

turedly. Roy B. Carpenter Jr., chairman of Lightning Eliminators and Consultants (LEC), Boulder, CO, wrote in an article published in *Communications Technology* magazine that the FAA hired a consulting engineering company to evaluate test data, and that the data show favorable results. When asked, Carpenter would not identify the consultant. LEC makes the second brand of equipment being tested.

Garry responded: "Not true. No consulting firm was hired to evaluate the systems."

The office of FAA administrator James B. Busey, responding to written questions submitted to Busey on April 4, 1989, by U.S. Rep. Martin Sabo (D-MN), wrote: "We do not have any evidence that the Tampa or Orlando towers have had a direct lightning strike or of the effectiveness of the lightning dissipation devices."

The tests, which began in 1988, continue. Written answers sent by Busey's



BEST SIMPLEX PATCH AVAILABLE

FEATURES:

- Automatic Set-up
- User Programmable CW-ID
- Phone Line In Use Inhibit
- Call Waiting
- Hook-Flash
- Turn-A-Round Beeps
- Automatic Busy Disconnect
- Single or Multi Digit Codes
- Toll Restrict
- Toll Restrict Defeat Code
- Tone or Pulse Dialing
- Ring-Out (Reverse Patch)
- Half Duplex Mode

The VCS-2100, uses a combination of VOX control from telephone line audio, and sampling of receiver noise, to achieve the optimum control method for a simplex interconnect. No sampling interruptions occur during normal conversation. Turn-a-round beeps make operation very smooth and easy.

The VCS-2100 also features the ISI exclusive, Automatic Setup. This feature eliminates the trial and error method of sample window setup. Our Quick Start Set-up procedure gets the VCS-2100 up and running, without complicated programming.



**INTERCONNECT
SPECIALISTS INC.**

Phone (407) 332-0533 • Toll Free 800-633-3750
1215 N. CR 427 • Suite 105 • Longwood, Florida 32750
FAX NO. (407) 332-4912

Circle (47) on Fast Fact Card

office read further: "We do not feel the lightning dissipation devices have been installed long enough to collect data for an accurate evaluation. It is estimated that each tower should be hit once in a five-year period in this high [lightning] activity area."

Joseph Foley, executive director for the Washington, DC-based Coalition Against Non-effective Lightning Protection Technologies (CAN'T) said: "While it is highly commendable that the FAA has decided to conduct tests on lightning dissipation systems technology, it is necessary that the scientific validity of these tests be rigorously maintained." Foley said that a false positive evaluation of the devices by an agency such as the FAA could have far reaching effects within the lighting protection industry and possibly could affect future airport safety.

A statement from CAN'T reads that Rep. Sabo is preparing a letter to Bussey requesting that the scientific validity of the tests be examined and, if necessary, the testing conditions be restructured to produce scientifically valid results.

Meteor-burst system aids in return of truck

The use of a meteor-burst two-way communications system netted the tracking and return of a stolen truck loaded with refrigerators. The Load-Trak system by Pegasus Message Corporation, Herndon, VA, traced the truck from Philadelphia to Mantua, NJ, unknown to the thieves. The cargo was returned in tact.

Millicom consortium applies for personal network license

A consortium with Millicom, New York, as a 14% interest holder, has filed for a personal communications network (PCN) license in the United Kingdom. The proposed radio-based system will provide portable telephone service at a comparable cost to the existing public switched telephone network.

Vehicular Technology Society picks Orlando for 1990 meet

The 40th Institute of Electrical and Electronics Engineers (IEEE) Vehicu-

lar Technology Conference will be in Orlando, FL, May 7-9, 1990. Sponsored by the institute's Vehicular Technology Society, the conference at the Sheraton Florida Mall is expected to draw more than 600 participants. For information, call George McClure at 407-356-3782.

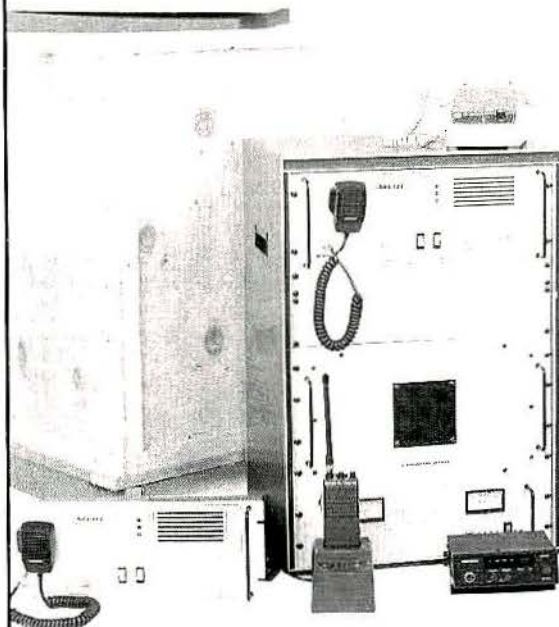
The previous conference in San Francisco tallied more than 540 participants and 144 papers. Digital topics com-

prised 32% of the papers; cellular, 20%; and guided radio systems, 8%.

The international conference drew papers from the United States (66), Japan (25), Canada (17), England (8), West Germany (6), Sweden (4), Italy (3), Spain (2), Iran (2), Netherlands (2) and one each from Saudi Arabia, Australia, Switzerland, Egypt and India.



Radio System Designs are Our Business!



When you receive a complete system package from CELLTRONICS USA, you can be assured it will perform to specifications. We test each product and then test the system before it ships . . .
... we promise.

Steve Lemons
President

Systems available in 30-50, 66-88, 136-174, 220-260, 406-512, 806-870, 928-960 MHz Bands:

- Base Stations
- Repeater
- IMTS Phones
- Mobiles
- Portables
- Mobile Phones
- Digital Paging Transmitters

FAX (619) 587-0049



Celltronics

10040 Mesa Rim Road • San Diego, CA 92121 • (619) 587-0656 • TELEX 4993540

Shop owners should use council participation as a reward

Membership on the Association of Communications Technicians (ACT) council could serve as a reward a shop owner might bestow upon a superior technician employee.

Council member Gordon Forbes said: "We are looking to contact shop owners in areas where we hold our meetings. We want to ask them whether they have a technician they want to reward with membership on the council and have the technician come to the semi-annual and annual meetings to offer grassroots support from the field."

Forbes said he first was named to the council by NABER when ACT was formed. "I called them to open a local chapter. My enthusiasm led them to invite me to the first meeting and then to be on the council."

Certification exams

Membership services coordinator Chris Cavanagh said examinations of candidates for the NABER technician

certificate have been scheduled at 120 sites in 43 states. Two exceptions are noted. For locations and times, call 800-759-0300 and ask for "technician services." Here is the schedule:

Jan. 19 and 20
March 23 and 24

March 30 at IMCE show
May 12 at NABER's annual meeting at Saddlebrook

May 18 and 19
June 23 and 24



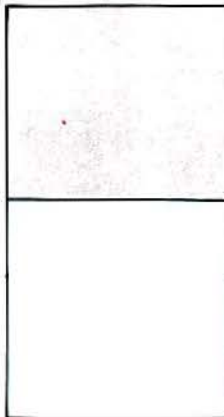
Information

For information about ACT, call 800-759-0300. Ask for "technician services."

ACT membership drive

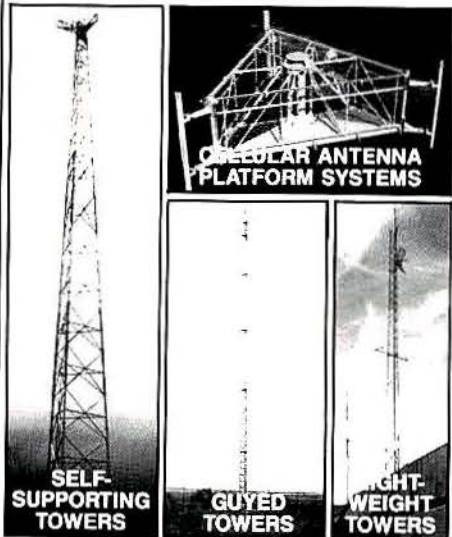
500

258



During its March 1989 council meeting, ACT set a goal of adding 500 new members during the following 12 months. As of Oct. 1, 258 new members have joined.

CELLULAR AND LAND MOBILE Antenna Support Structures



Thirty years of providing superior engineering, fabrication, and construction for the communications industry.

For more information, contact:



MICROFLECT

3575 25th St. SE • P.O. Box 12985
Salem, Oregon 97309-0985
(503) 363-9267 • TLX 510-599-0107

Interference patrol

Responsibility for controlling interference on shared channels lies first with radio users:



- Listen before you transmit on a shared channel. Learn how to disable the squelch to listen for other users.
- Use your call sign whenever you use the radio.
- If you use a scrambler for privacy on a shared channel, sign off "in the clear" so other users know you are finished.
- Have your radio serviced periodically to be sure it is on frequency.
- Keep communications brief to promote harmony with other users who share the channel.
- Use the minimum transmitter power and antenna height you need to cover your area. That might be less than the power and antenna height specified on your license.

System operators:

- Post the name and 24-hour phone number of the site manager at the access point for each antenna site.

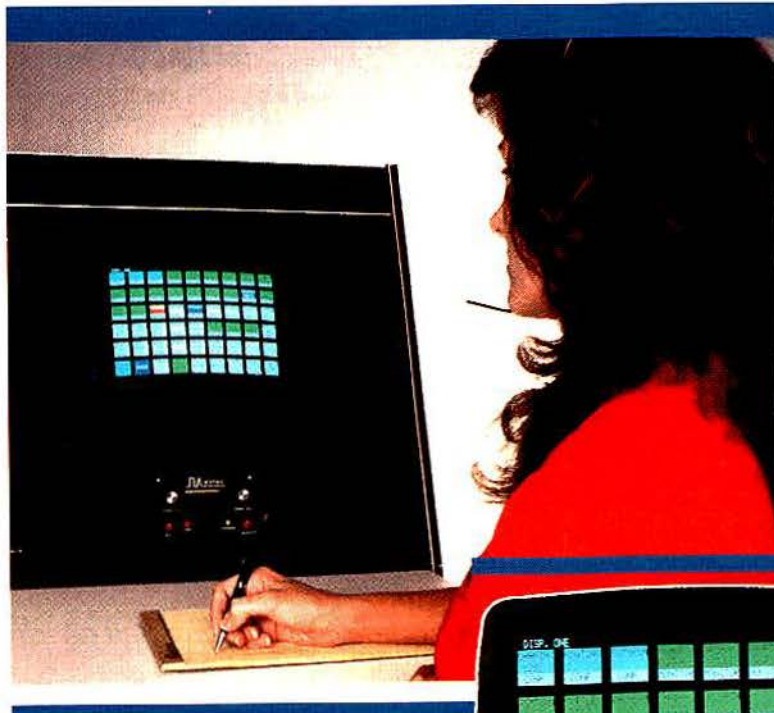
A public service message from

Mobile Radio Technology

TOUCH-TO-TALK

Color Touchscreen Console Systems

From  **avtec**



ACCESS

ACCESS - Advanced Concept Communications Exchange and Signaling System — is a fully integrated, non-blocking, radio/telephone console system. ACCESS systems have been providing dispatch solutions for public safety, utilities, railroads, military, and other government and private agencies for more than six years.

A single touch of the infrared technology screen can control:

- ▶ Up to 240 radio or telephone lines
- ▶ Up to 29 operator positions
- ▶ Multi-format paging
- ▶ Auto dial directories
- ▶ Intercom
- ▶ Shift changes
- ▶ Conferences and patches
- ▶ ANI



PBX SCREEN



MAIN SCREEN

User friendly, menu driven maintenance terminal offers:

- ▶ Dynamic reconfiguration
- ▶ Extensive diagnostics
- ▶ Management reports
- ▶ System test
- ▶ Maintenance aids

NOW AVAILABLE UNDER GSA CONTRACT

Call or write today:

 **avtec**

**PO Box 599
Batesburg, SC 29006, USA
(803)892-2181
FAX (803)892-3715**

FCC chairman Sikes: 'Improve your services'

"Focus on improving the excellence and quality of your services and the competitiveness of your prices," FCC chairman Alfred C. Sikes told an audience at October's Telocator convention in Washington, DC. "Be more responsive than ever to the needs of your customers." Sikes listed economic challenges, including government

deficits, trade deficits, education and health care as problems that mobile communications help to solve.

"The key to solving our national problems lies in the underlying strength and competitiveness of the American economy," he said. "While lots of technologies and industries are quick to promise productivity, the fact remains



Alfred Sikes: 'Be more responsive than ever to the needs of your customers.'

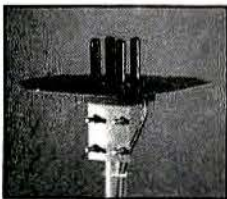
that it is still the mobile communications sector that reliably delivers it."

Sikes spoke about unshackling common carriers and breaking down block allocations of radio spectrum.

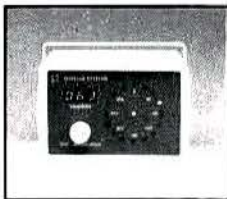
- With respect to the Communications Act of 1934, he said: "The current statute, for example, does not give the FCC the flexibility to fully deregulate companies engaged in communications 'common carriage for hire.'"

- Regarding block allocations, the

108-1000 MHZ RADIO DIRECTION FINDING



- ★ Interference Location
- ★ Stuck Microphones
- ★ Cable TV Leaks
- ★ ELT Search & Rescue



New Technology (patented) converts any VHF or UHF FM receiver into a sensitive Doppler shift radio direction finder. Simply plug into receiver's antenna and external speaker jacks. Models available with computer interface, synthesized speech, fixed site or mobile - 108 MHz to 1 GHz. Call or write for details.

DOPPLER SYSTEMS, INC. P.O. Box 31819 (602) 488-9755
Phoenix, AZ 85046 FAX (602) 488-1295

Circle (51) on Fast Fact Card

VOX RADIO LINK™

An Intrinsically Safe Way to Talk

through your SCBA mask and be hands-free on your portable radio at the same time. LOUDMOUTH™ voice quality improves 2 way communications. Adjustable VOX and convenient, PTT capability. Waterproof, rugged and lightweight. Minimum cabling. Equipped for use in high noise areas. Works with any breathing apparatus.



LOUDMOUTH VOX RADIO LINK™



EARMARK®

1125 Dixwell Ave., Hamden, CT 06514 USA
Telephone (203) 777-2130
FAX (203) 777-2886

LRUV1 *Systems Communications For Productivity*

Circle (52) on Fast Fact Card

**Look what Primus
has in stock
for same day shipment
to you!!**

Impulse Suppressors

PolyPhaser

Antennas

Decibel•Maxrad•Cushcraft

Cable/Connectors

Amphenol•Andrew•RF Industries

Belden•Tyton

Test Equipment

Bird•Decibel•Goldstar•Hameg

Helper•IFR•Telewave

Primus.

**Meeting your communications
needs into 1990 and beyond.**

primus

ELECTRONICS CORPORATION

FAX #815-436-8945 • 800-435-1636 • [IL] 800-892-1413

Circle (53) on Fast Fact Card

chairman said: "If someone wishes to innovate, to make use of the spectrum for a purpose that has not been foreseen, elaborate procedural steps are required. The FCC can grant 'experimental' licenses, of course. But the overall system, again, is geared to accommodating known, predictable applications—not facilitating innovation."

The chairman spelled out no specific initiatives for deregulation or allocations, except to say: "We need to do more to make the current radio regulatory environment more conducive to the cost-reducing and the demand-inducing innovation."

FCC objectives Sikes mentioned include taking into account the international implications of FCC actions; reaching decisions faster; and making better use of radio spectrum.

Power item pits factions against one another

Power and antenna height increase requests from two paging companies and

a trade association drew opposition from the Associated Public-Safety Communications Officers (APCO). Petitions filed with the FCC by SkyTel, Megamessage and Telocator ask for the increases in connection with 900MHz local and national paging frequencies.

APCO contends increased adjacent-channel interference would harm public safety communications.

The National Association of Business and Educational Radio (NABER) cites harmful interference in its opposition to a Telocator petition for power increases on 152.03MHz and 152.52MHz. NABER expects receivers on adjacent channels to suffer interference. Telocator notes that the FCC usually does not offer protection to receivers on adjacent channels.



THE INSTALLER'S FRIEND



The MATCHBOX™
Model MB800 \$650.00

FAX: 407-777-1447

800-327-9308 / 407-777-1440

ANTENNA TESTER

Tests Cellular and SMR mobile antennas over full transmit and receive bands. Simple operation: Adjust the MB800 to the desired frequency and read SWR and Match Efficiency directly. No computation required. Generates its own test signal. No transceiver needed.

HELPER INSTRUMENTS CO.

LEADERS IN INNOVATIVE TEST EQUIPMENT
131 Tomahawk Dr., Indian Harbour Beach, FL 32937

Circle (77) on Fast Fact Card



SCALA

RADOME-PROTECTED ANTENNAS

These antennas are designed for optimum system performance and reliability in the most severe environments. Each antenna is completely enclosed in a heavy fiberglass radome attached to a thick cast aluminum backplate. The radome's slick gelcoat finish resists ice buildup. All fastenings and hardware are of corrosion-resistant stainless steel. You can depend on Scala quality, proven in professional broadcast and communication systems around the World during the past 36 years.

CL-400	Log-Periodic (8 dBd) Broadband 400-512 MHz	\$ 370
CL-900	Log-Periodic (8 dBd) Broadband 800-1000 MHz	\$ 370
RY-900	Yagi (10 dBd) for 928-953 MHz Multipoint Service	\$ 370
RA5-450	Yagi (10 dBd) for specific frequency (400-512 MHz)	\$ 370

SCALA ELECTRONIC CORPORATION
Box 4580, Medford, Oregon (USA)

Phone: (503) 779-6500
FAX: (503) 779-3991

Circle (54) on Fast Fact Card

Readers' choice

Of all the new products, services and "Product Preview" items covered in the May 1989 issue of *MRT*, the ones reprinted here generated the most reader requests for additional information. If you missed them the first time, here is your opportunity to acquire more information on them: Just circle the corresponding Fast Fact number on the Fast Fact Card found in the back of this issue and mail the card to us.

UHF antenna incorporates cellular look

A cellular look-alike antenna by Sti-Co is matched to exact UHF frequencies. The 13-inch antenna fits most cars and is available in a trunk lip-mount configuration.

Circle (513) on Fast Fact Card

Portable operation extends as far as 6 miles

Instant local communications at ranges as far as 6 miles are available with Trycomm's TR-105 miniature transceiver. The portable unit carries both voice and data messages and covers the 150MHz to 174MHz band.

SWR measurement kit works with service monitors

The operating range of the swersweep SWR measurement kit has been extended to cover 1MHz to 1,000MHz. The kit works with service monitors that have a tracking generator and spectrum analyzer, such as the IFR 1200S. Offered by Europa Marketing, the kit allows a service monitor to display a plot of SWR vs. frequency

The 6W unit comes with a 450mAh rechargeable battery, ac charger-adaptor, flexible rubber antenna, stainless steel belt clip, protective case and a fast-slow rate drop charger.

Circle (515) on Fast Fact Card

cy on the CRT to allow quick, accurate tuning of antennas, duplexers, isolators, combiners and receiver front ends. Each swersweep has calibration traceable to the National Institute of Standards and Technology (formerly the National Bureau of Standards).

Circle (514) on Fast Fact Card

Base station antenna line includes heavy-duty models

Cushcraft/Signals' base station antenna line includes antennas for every application. Product includes heavy-duty repeater antennas, control station

antennas, economy omnis and special antennas for point-to-point use.

Circle (512) on Fast Fact Card

"Give Your Competition The ^{new} Old One-Two!"

You have to be pretty sharp to stay ahead in the two-way repair business. That's why we built the COM-3. It works as hard as you do and for the money, you won't find anything as fast and powerful as the COM-3. In fact, it outperforms units costing over twice as much.

How did we do it? Simple. COM-3 is all new—new design, new electronics. You won't get bogged down by complex and antiquated technology. Instead, COM-3's advanced and powerful microelectronic circuits speed you through test routines. You get more work done, faster and easier than ever before.

And now, here's the knock out—introducing the all new Ramsey COM-7 Spectrum Analyzer. The proof is in the picture. High-

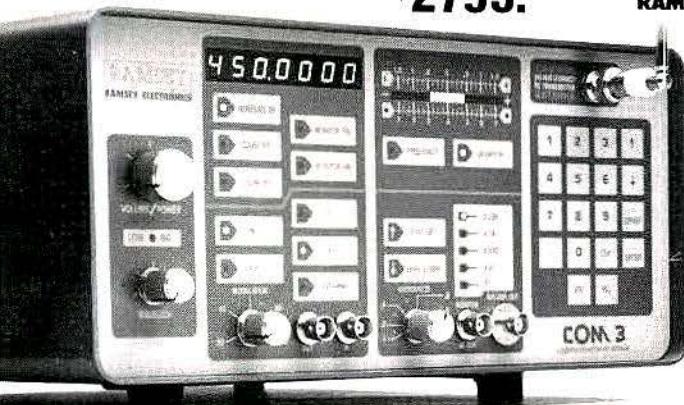
performance circuitry provides remarkable sensitivity for superb, high-resolution frequency analysis and observation. Interference location and characterization is easier than ever. Not only can you see the interference, you can hear it too. A variable bandwidth audio demodulator allows you to detect and audibly identify the interfering signals. In addition, a true frequency counter display speeds center frequency setting and reading. Frequency range covers the entire 1 MHz to 1000 MHz spectrum. Add the optional tracking generator and you can easily tune duplexers, filters and cavities!

The Ramsey COM-3 and the all new COM-7, two mean machines designed to help you knock out the two-way competition.

COM-3 COMMUNICATIONS SERVICE MONITOR **\$2795.00**

RAMSEY
RAMSEY ELECTRONICS

SPECTRUM ANALYZER **COM-7**
\$3495.00



ASK ABOUT OUR EASY TO OWN LEASE PLAN

Circle (55) on Fast Fact Card

Ramsey Electronics, Inc. 793 Canning Parkway Victor, NY 14564 Order Factory Direct Call 716-924-4560 FAX: 716-924-4555

Digital pager features field programmability

The ICM Communications' digital pager includes an LCD, 12 message slots, 120-digit memory and six addresses. With an optional programmer, the pager can be customized with codes and options.



Circle (319) on Fast Fact Card

Dispatch console comes in three versions

The Ultra-Com 96 dispatch console uses digital switching and digital audio technology. Made by **Modular Communication Systems**, the system includes self diagnostics and a management information package. It comes in three versions: conventional switch

module; integrated switch and super twist LCD; and CRT versions. The CRT and LCD versions offer personal vehicular status that can be used as a paging and auto-dial system when used with the Ultra-Page 96 encoder.

Circle (376) on Fast Fact Card

Trunk system expands to five-channel capacity

The RTX V controller made by **Ba-sic Communications** enables interconnect, paging and mobile-to-mobile signaling. The trunked system supports

two- and four-wire E&M interfaces. The system starts as a single channel and is expandable to five trunked channels.

Circle (373) on Fast Fact Card

Replacement batteries serve four Standard portables

Alexander Batteries makes replacement batteries for Communicate HX407 and Standard HX400 portables:

☐ Model H26240 12.5V 500mAh replaces Standard model CNB40 and

Communicate model CNB40T.

☐ Model H26241 12.5V 900mAh replaces Standard model CNB41 and Communicate model CNB41T.

Circle (335) on Fast Fact Card

RadioMate Headsets

Lightweight Headsets for Radios

- A complete headset with PTT and radio cord/plug all in one. No extras to buy.
- Variety of styles for user comfort and versatility.
- Professional-quality headsets backed by in-house repair and warranty service.



RadioMate Distributed by

hcs Company
Telecommunications

Specializing in
HEADSETS

Call toll free **1-800-346-6442**
In CA **1-415-676-3376**

Circle (56) on Fast Fact Card

*Hutton has
what it takes!*

HELIAX®

Hutton Communications is now your direct connection to **ANDREW HELIAX®** in large quantity or small. Hutton can supply all of your next HELIAX®, Superflexible, or Radiax® order with your choice of connectors installed and guaranteed. PLUS we have hoisting grips, hangers and grounding kits IN Stock. Check off your next order and call HUTTON.

1-800-442-3811

Main Feeders

- ☐ 1/2" Heliax® _____ ft.
☐ 7/8" Heliax® _____ ft.
☐ 1-1/4" Heliax® _____ ft.
☐ 1-5/8" Heliax® _____ ft.

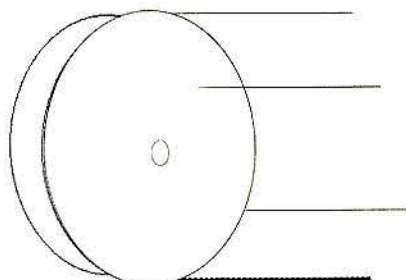
Jumpers

- ☐ 1/4" Superflexible Jumpers
☐ 1/2" Superflexible Jumpers

Heliax® Accessories

- ☐ Hoisting Grips _____ pcs.
☐ Tower Hangers _____ pcs.
☐ Standoff Kits _____ pcs.
☐ Grounding Kits _____ pcs.
☐ Connectors _____ pcs.

Now we're rollin'
HELIAX®



Reels or Boxed

Heliax® is a trademark of the ANDREW Corporation.

Distribution Services of M. Hutton & Company

Headquarters
Hutton Communications
3240 Garden Brook Drive
Dallas, Texas 75234-2309
214-484-0580
800-442-3811
Fax: 214-484-9254



Sales Agency
Hutton National
9810 FM 1960, Suite 215
Humble, Texas 77338
713-446-4050
800-325-8950
Fax: 713-446-5779

Circle (59) on Fast Fact Card

New products

Replacement battery fits NEC cellular phone

Model CL2039 replacement battery fits NEC 9A, P9000 and P9100 cellular phones. The **Alexander Batteries** unit has a 1.0Ah capacity with 7.2V. It provides 90 minutes of talk time and five hours of standby operation.



Circle (309) on Fast Fact Card

Throat mic is suited for hazardous environments



Model THR-3 throat mic is designed to reduce low frequency spectrum components and to operate in difficult and hazardous environments. The **Earmark** mic replaces the company's THR-2 throat mic.

Circle (334) on Fast Fact Card

QUARTER KILOWATTS RUNNING A FEW QUARTS LOW?



TUBES RUNNING A BIT FLAT? HIGH VOLTAGE LEAKING?
FEEL LIKE YOUR TRANSMISSION'S SLIPPING?

An older Amp is like a fine old car. It was great in it's day but you can never tell when your transmission is going to fail.

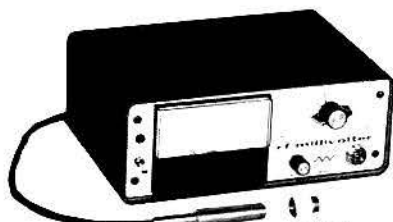
VoCom PRODUCTS USA MADE **SOLID STATE** REPLACEMENTS FOR MOST OEM POWER AMPLIFIERS. CALL US NOW — THE CALL IS FREE!

1-800-USA-MADE (1-800-872-6233)
(In Illinois Call 312-885-3296)

VoCom
PRODUCTS CORPORATION
1161 E. TOWER ROAD
SCHAUMBURG, IL 60173

Circle (58) on Fast Fact Card

RF MILLIVOLTER™



RF-801

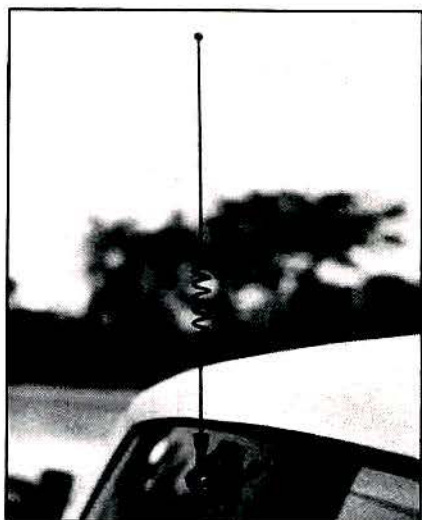
20kHz to 1.5GHz
300 Microvolts to 100V
Circuit Loading < 2 pF
\$750 complete w/probe

407/777-1440 800/327-9308
FAX: 407/777-1447
TELEX: 362837 (Helper UD)

HELPER INSTRUMENTS COMPANY
P.O. Box 3628
Indianapolis, Florida 32903 USA

Circle (57) on Fast Fact Card

UHF glass-mount antenna resembles cellular model



Model AP-453 low-profile UHF glass-mount antenna covers the 440MHz to 470MHz range. The **Antenna Specialists'** disguise antenna resembles a cellular antenna by incorporating a spiral whip design. It has a three-fourths wavelength, 18-inch stainless steel whip and accepts 100W continuous power. Nominal impedance is 50Ω. The antenna comes with 15½ feet of cable and a UHF male connector.

Circle (375) on Fast Fact Card

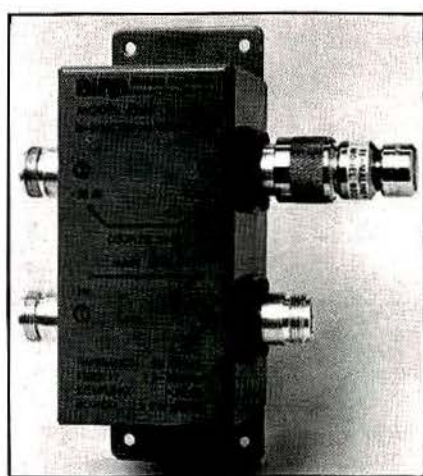
**Simplex transceiver
covers two channels**



The Procom 2X2 2W simplex hand-held comes with one set of crystals for 151.625MHz, 154.570MHz or 154.600-MHz. Another set of crystals may be installed into the two-channel unit to cover one additional frequency. Made by **Fannan Courier**, the unit includes a rechargeable NiCd battery pack, ac battery charger and antenna.

Circle (310) on Fast Fact Card

**Bidirectional coupler
offers 1,500W CW rating**



Model 4266 high-power bidirectional coupler features a continuous rating of 1,500W continuous wave in the primary line. Made by **Bird Electronic**, the coupler includes a low insertion loss of 0.1dB and VSWR less than 1.05.

Circle (332) on Fast Fact Card

Radiotelephone link contains dc power-saving circuitry

DX Radio Systems makes a radiotelephone link that offers plug-in modular construction, microprocessor system control and remote line testing. Other features include metering facilities and dc power-saving circuitry.

Among the options available are party line for as many as eight users; speech privacy kit; subscriber line test tone generator; switch hook flash; and pay phone operations.

Circle (342) on Fast Fact Card

B1225 VOICE ALARM

Works with all normal 2-way radios

FEATURES

- Electronic voice storage.
- You record your voice in RAM.
- 1 site ID & 8 alarm inputs per unit.
- All parameters field programmable.
- Remote alarm acknowledgement.
- The B1225's own vocabulary talks you through the programming.
- 4 DTMF controlled relay outputs (unit verbally confirms relay output).
- Transmits DTMF, 5 tone, 2 tone or single tone with voice message.

TYPICAL APPLICATIONS

- Oil company facilities eg: batteries, ESD valves, compressors.
- Municipal facilities eg: water level, intrusion alarms, pump monitor.
- Remote radio sites eg: AC power failure, battery voltage, tower lights.

BENEFITS

- Reduced down time.
- Site security.
- Safety.
- Cost effective.

DEALER PRICE US \$449.



Quality Telecom Supply Ltd. (403) 293-1965

2874 Catalina Blvd. N.E., Calgary, Alberta, Canada, T1Y 6P2

FAX (403) 285-2202

Circle (60) on Fast Fact Card

*Hutton has
what it takes!*

Celwave

**Super Stationmaster™
Base Station Antennas**

When you think
base station, think
Hutton Communications
and
Celwave RF

Super Stationmaster™ UHF base antennas incorporate certain design enhancements not available in other fiberglass collinear antennas. The for instance, the PD455 combines 10MHz bandwidth with improved lightning protection while preserving the desirable lightweight characteristics of the antenna. The PD755 keeps the same electrical specifications of the PD455 while providing outstanding ruggedness for really severe weather locations. Celwave antennas comply fully with the EIA329 standards for testing antenna gain.

Hutton can supply a wide range of Celwave RF products from antennas to multi-port combiner systems to many sizes of Celwave-coaxial cable. Hutton is your very best choice for your supplier of Celwave Super Stationmaster™ antennas and any of the other fine Celwave RF products

Call 800-442-3811

Ask for ext. #125 for more information

Distribution Services of M. Hutton & Company

Headquarters
Hutton Communications
3240 Garden Brook Drive
Dallas, Texas 75234-2309

214-484-0580
800-442-3811
Fax 214-484-9254



Sales Agency
Hutton National
9810 FM 1960, Suite 215
Humble, Texas 77338
713-446-4050
800-325-8950
Fax 713-446-5779

Circle (61) on Fast Fact Card

New products

Wideband synthesized mobile incorporates EEPROM



The PSX-SE PTT synthesized mobile from **General Electric** offers 40W VHF and 25W UHF output. The radio's exterior is made of die-cast aluminum. Features include Channel Guard, carrier control timer and EEPROM.

Circle (325) on Fast Fact Card

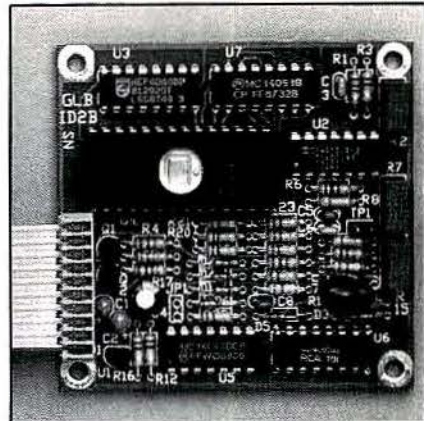
Repeater panel boasts low-power option



Zetron's low-power option for its model 38 repeater panel enables the panel to draw only 60mA during operation. The unit includes decoding circuitry, airtime accumulation and airtime hog timers.

Circle (327) on Fast Fact Card

CW identifier features Eight EPROM messages



Model ID-2B CW identifier offers eight selectable and reprogrammable EPROM messages; ID over voice inhibit; and adjustable interval timer, speed and audio. **GLB Electronics'** modular unit is available with low power and special timing intervals.

Circle (370) on Fast Fact Card

B1260 VOICE ALARM

For your Radio System and/or Telephone

FEATURES

- Electronic voice storage.
- Custom alarm announcements.
- 8 optically isolated inputs per unit.
- Remote alarm acknowledgement.
- Transmits DTMF, 2 tone or single tone with alarm message on radio.
- All operating parameters are field programmable (locally or remotely).
- Auto-dialing of 8 phone numbers.
- Shares radio channel and phone line.
- Works on party lines.

TYPICAL APPLICATIONS

- Oil company facilities eg: batteries, ESD valves, compressors.
- Municipal facilities eg: water level, intrusion alarms, pump monitor.
- Remote radio sites eg: AC power failure, battery voltage, tower lights.

BENEFITS

- Reduced down time.
- Site security.
- Safety.
- Cost effective.



Quality Telecom Supply Ltd. (403) 293-1965

2874 Catalina Blvd. N.E., Calgary, Alberta, Canada, T1Y 6P2

FAX (403) 285-2202

Circle (62) on Fast Fact Card

Replacement batteries fit Motorola cellular phones

The WP-125-4500 replacement battery from **W & W Associates** fits Motorola Tough Talker cellular phones, models 2000X and 6800XL.

Circle (371) on Fast Fact Card

Two-tone decoder option fits portable transceivers

The plug-in two-tone decoder option from **Neutec** fits the company's Marathon portable radio series.

Circle (315) on Fast Fact Card

Adding a Trunk Channel?

TNT-100 LTR® Logic and Interconnect



Trident Micro Systems

10221 Slater Ave., Suite 103, Fountain Valley 92708 (800) 798-7881 or (714) 549-5206

Add or replace existing channels logic and interconnect. Fully compatible with Johnson and Uniden trunking systems. Works with CTCSS and all LTR® compatible radios. Full function interconnect with voice prompting. Networking using existing telephone lines.

Circle (63) on Fast Fact Card

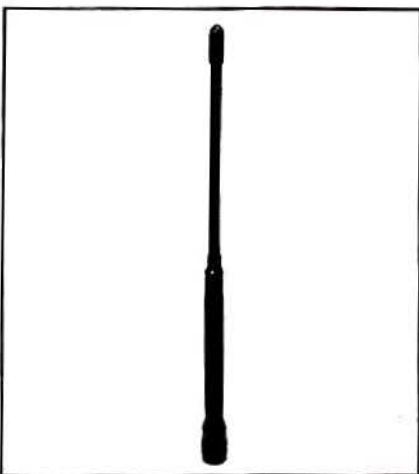
Monitoring system tracks remote transmitters



The Sentry DB8830-Pack 1 monitors and controls 25MHz to 1,000MHz radio systems with as many as five transmitters on an antenna. The system includes **Decibel Products'** DB8830 Sentry monitor with internal modem; voice reporter; connector kits; ac and dc converter; RJ11 telephone cable; mounting hardware; videotape and operations instructions; and warranty card.

Circle (348) on Fast Fact Card

3dB cellular antenna comes in 3 colors



The AM 850 half-wave flexible portable antenna from **Valor Enterprises** comes in red, white and black. The 3dB cellular antenna is available with TNC, right-angle build-on or mini UHF connectors.

Circle (411) on Fast Fact Card

Scalar network analyzer covers 10MHz to 520MHz

The SNA 300 portable scalar network analyzer is battery-powered and covers 10MHz to 520MHz band. Functions include measurement of antenna VSWR; measurement of antenna efficiency; measurement of coax cable insertion

loss; measurement of receiver input impedance; and antenna pattern indication. The **Direct Conversion Technique** analyzer weighs 4 pounds and offers three hours of battery operation in the field.

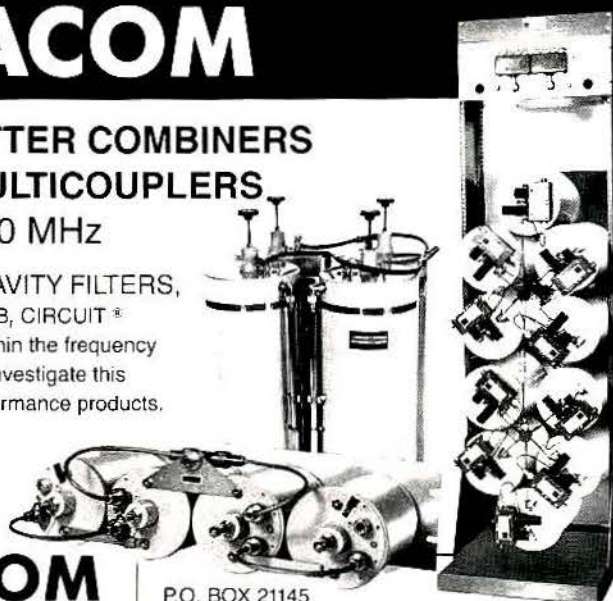
Circle (353) on Fast Fact Card

WACOM

LOW LOSS TRANSMITTER COMBINERS RECEIVER MULTICOUPLERS 150-450-800 MHz

DUPLEXERS and CAVITY FILTERS, including our patented B_p B₁ CIRCUIT[®] FILTERS, for all bands within the frequency range of 30 to 960 MHz. Investigate this complete line of high performance products.

CALL
817/848-4435



WACOM
PRODUCTS, INC.

P.O. BOX 21145
WACO, TEXAS 76702 • 817/848-4435

Circle (64) on Fast Fact Card

*Hutton has
what it takes!*

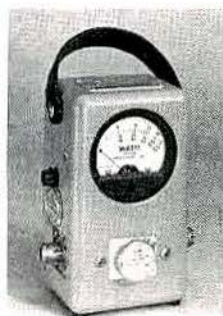
BIRD

Power Measurements

THRULINE[®]
4304A
5-500Watts
25-1000 MHz
Quick Change
Connectors
Original
Bird Quality
In Stock!
\$425.00



Call Hutton for same day shipment* on BIRD products advertised in this ad. Free freight* on orders over \$400.00 when you mention this ad.



THRULINE[®]
Model 43
The trusted
method of RF
measurement for
thousands.
We have
accessories
TOO!
\$195.00

Range in MHz --	A. 25- 60	B. 50- 125	C. 100- 250	D. 200- 500	E. 400- 1000
Power \$	\$55.00	\$55.00	\$55.00	\$55.00	\$55.00
10	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
25	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
100	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
250	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
500	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00
1000	\$5.00	\$5.00	\$5.00	\$5.00	\$5.00

*UPS Brown on orders placed before 2 pm.

Distribution Services of M. Hutton & Company
Headquarters
Hutton Communications
3240 Garden Brook Drive
Dallas, Texas 75234-2309
214-484-0580
800-442-3811
Fax 214-484-9254
Sales Agency
Hutton National
9810 FM 1960, Suite 215
Humble, Texas 77338
713-446-4050
800-325-9950
Fax 713-446-5779

Circle (65) on Fast Fact Card

Voice Alarm Units

- Electronically record and store your voice.
- Automatically report on your radio system.
- Automatically dial phone numbers and report.

A Modem for Your Radio

- Data rates up to 4800 bps sync or async.
- Works with all normal 2 way radios.
- Does not use packet technology.

Remote Control/Monitor

- Monitor and control remote site status by radio.
- RS232 interface for connection to PC or printer.



Quality Telecom Supply Ltd. (403) 293-1965

2874 Catalina Blvd. N.E., Calgary, Alberta, Canada, T1Y 6P2

Circle (66) on Fast Fact Card

Base stations, repeaters come in varied configurations

Fixed station equipment, including base stations and repeaters, from **DX Radio Systems** feature modular construction and are available in a variety of configurations. Standby current drain is 10mA for battery operations. Options include back-to-back repeater, hot standby systems, radiotelephone link and telemetry.

Circle (329) on Fast Fact Card

Repeater unit works with two transceivers

The DGRM 501 Repeater Maker unit from **AAA Communication Manufacturers** uses a digital gate circuit for repeater functions control. The unit works with most transceivers and requires two for operation. Features include controlled audio; PTT with a delay from 1 second to 30 seconds; squelch control; and low operating current.

Circle (372) on Fast Fact Card



SHINWA'S SYNTHESIZED MOBILES UHF/VHF/LO BAND

Exclusive Features

- Strong diecast aluminum frame
- High Power; 40W UHF / 50W VHF / 50W-120W Lo Band
- Memory scan with priority (memory scan channels are programmed from front panel)
- Priority scan (priority channel is selectable from front panel)
- Noise blanker standard feature on Lo Band
- Compact size: 2"H x 7-1/8"W x 8-11/16"D (50 x 180 x 220 mm)
- Available options include: 3W external speaker, CTCSS, 2-tone decoder, DTMF microphone, voice storage

Distributed by

SHINWA

COMMUNICATIONS OF AMERICA, INC.

P.O. BOX 26407 / OKLA. CITY, OK 73126 / 405-232-7272 / 1-800-627-4722

Circle (67) on Fast Fact Card

Report covers ACSSB modulation

The Intelligibility of Amplitude Companded Sideband Modulation Compared to Conventional Frequency Modulation by the **National Institute of Justice**, offers background information on ACSSB as a suitable narrowband modulation technique. NIJ Report 201-87 provides a functional description of ACSSB, performance measurements and observations of three operational ACSSB systems.

Circle (273) on Fast Fact Card

Brochures describes duplexer product line

TX RX Systems describes its line of duplexers in four brochures. The featured duplexers in broad frequency ranges are: 30MHz to 136MHz, No. A1004; 132MHz to 250MHz, No. A1104; 406MHz to 512MHz, No. A1204; and 806MHz to 1300MHz, No. A1304.

Circle (274) on Fast Fact Card

Catalog includes regulated power supplies

Ritz Electronics' Ltd. catalog explains stock products manufactured under the "Relco" name. Stock items include electronically and magnetically regulated power supplies and metal cabinetry. Items for original equipment manufacturers are included.

Circle (271) on Fast Fact Card

Brochure features seven-range voltmeter

Model 2610 true RMS by **Marconi Instruments** is described in a brochure. Features include 25MHz true RMS voltage measurements over seven ranges; high input impedance with ac or dc coupling; decibel readout availability and a GPIB interface.

Circle (275) on Fast Fact Card



SERVICE MONITOR MEASUREMENTS MODEL FM 110

- Covers all business channels from 30MHz to 512MHz
- Monitor: 2uV, frequency error display, scope deviation display
- Generator: Calibrated output up to 10mV, Sinad display
- Built-in Tone Generator
- Full Duplex capability

\$2450.00

FOB - BATESBURG, SC



WE ACCEPT VISA, MASTERCARD & AMERICAN EXPRESS

AIE CORPORATION — MEASUREMENTS DIVISION
PO BOX 70, BATESBURG, SOUTH CAROLINA 29006 (803)532-9256



Circle (68) on Fast Fact Card

...ever get the feeling
your running your paging
terminal in the dark?



Most systems operate at 30% or less efficiency.

Is yours one of them?

Unfortunately simple page formatters, stat cards and call counters won't shed any light.

You need full "off the air" system analysis.

You need the **Interceptor 5103™.**

Automatic digital format detection allows for unattended operation.
Real-time display of received paging data in multiple formats.
Real-time analysis of batch efficiency by format.
User selection of target capcodes for selective capture and testing.
Keyword search allows for screening of pages by message content.
Date/time stamping of all received pages.
Selectable printer/disk logging of all paging traffic.
Built-in report generator for user definable reports.
On-line storage of captured batches displays content by frame.
Wrap-around 24 hour statistical summary of paging traffic by format provides breakdown of airtime usage, total paging through-put, message content, and format efficiency for evaluation of channel loading.
Off-line utilities to help you maximize your system through-put, minimize delay time and increase channel loading capacity.

See why our customers say.

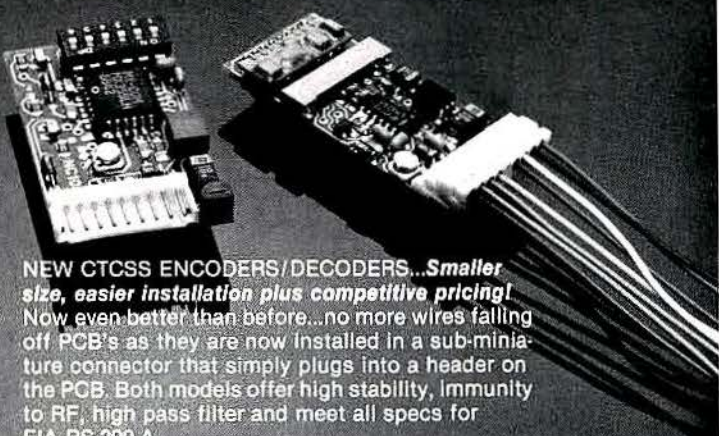
"This is the best piece of test equipment to come along in years."

Call for your free Demo Disk today!

Statistical Control Systems Corporation
3430 27th Parkway • PO Box 2844
Sarasota, FL 34230-2844
813-954-8816 / 8819 • Fax 813-954-8624

Circle (69) on Fast Fact Card

WELL CONNECTED.



NEW CTCSS ENCODERS/DECODERS...Smaller size, easier installation plus competitive pricing!
Now even better than before...no more wires falling off PCB's as they are now installed in a sub-miniature connector that simply plugs into a header on the PCB. Both models offer high stability, immunity to RF, high pass filter and meet all specs for EIA RS-200-A.

Model NC102 — Size: 0.8"W x 1.60"L x 0.20"H

Model NC106 — Size: 1.0"W x 1.7"L x 0.22"H

Call or write today for pricing and full specifications.



TOLL FREE SALES 800-874-8663 / In California Call (916) 477-8400 / FAX (916) 477-8403
12438 Loma Rica Drive "A" / Grass Valley, CA 95945

Circle (70) on Fast Fact Card

The next logical step in the future of your service business ...

Computerizing your service operation can be a big step. But, it's one the future will most certainly demand.

We provide software and experience that can make the whole process easier and much more affordable than you may think.

From a simple service management program to a multi-user network that integrates sales, service, accounting, dispatch, repair analysis and SMR billing - we do it all! ... and we're here to help you do it right!



Micro-Quick Systems, Inc
10384 Hillside Rd.
Alta Loma, CA 91701
TEL: (714) 980-1034
FAX: (714) 944-3995

Intelligent Software for Managers who take their service business very seriously!

Circle (71) on Fast Fact Card

Feedback

Readers name mobile radio industry leaders

VHF highband mobiles are the most popular types of mobile radio used according to the respondents to the June "What Do You Think?" questionnaire; 46.3% of the respondents are involved in public safety and government operations, followed by 37% dealer respondents. Types of mobiles used are reported in these statistics (Multiple responses add up to more than 100%.):

TYPE OF MOBILE	%
VHF highband	74.1%
UHF	72.2%
VHF lowband	50.0%
800MHz	33.3%
HFSSB	13.0%
ACSSB	0
No response	1.9%

Respondents are active buyers of mobile radios with 92.6% indicating they have purchased mobiles in the last 12 months. Only 7.4% have not bought any mobiles in the last 12 months.

The four manufacturers that readers picked as the industry leaders are Motorola, General Electric, E. F. Johnson and Midland LMR. Bendix/King and Kenwood are tied for the next slot. Multiple responses add up to more than 100% as reported in these statistics:

INDUSTRY LEADERS	%
Motorola	87.0%
General Electric	61.1%
E. F. Johnson	35.2%
Midland LMR	25.9%
Bendix/King	18.5%
Kenwood	18.5%
Uniden	16.7%
ICOM	13.0%
Regency	7.4%
Yaesu	7.4%
Fujitsu	5.6%
Standard	5.6%
Teletec	3.7%
Larsen	3.7%
Other	31.5%



McGuire Lee Marangella Bousum

Michael G. McGuire exits Reliance Comm/Tec as director of marketing and sales for non-regulated markets groups to become senior vice president of sales and marketing for Antenna Specialists, Cleveland.

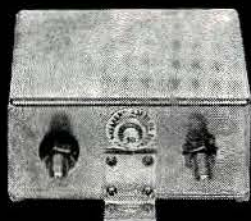
Bill W. Lee, national marketing and training director for the radio paging division of Graphic Scanning, Dallas, advances to vice president of training and development.

Mark Marangella departs Loral Teracom, San Diego, as sales manager to join NEC America's mobile radio division, Richardson, TX, as director of sales administration.

John O. Bousum leaves Labconco as material flow department manager to join Midland International, Kansas City, MO, as materials manager.



"Power" Full Protection



NEW 50 AMP INLINE DC

12VDC • 24VDC • -48VDC



SHUNT & NEW INLINE AC

120VAC • 240VAC • 480VAC

- 30 & 50 Amp DC protectors in negative ground standard.
- Positive and floating ground also available.
- Single & Three Phase AC shunt and new inline.
- Delta, Open Delta & Wye phase configurations.

We have a complete line of powerful protectors to suit your needs.

"To Keep YOU Communicating...We Changed BLITZ To BLISS"

K PolyPhaser

**Over 450
Products**

P.O. Box 9000 • Minden, NV 89423-9000
(702) 782-2511 or (800) 325-7170 • FAX: (702) 782-4476

Circle (72) on Fast Fact Card

NEW MODULAR MOUNTS FROM

GAMBER-JOHNSON

Extra heavy construction and your choice of configurations are now available in both StackMaster II and Data-Base!

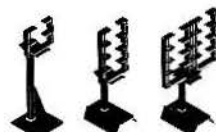
Choose the base that fits your vehicles and combine it with a mount structure tailored to your communications equipment.

FOR
COMPLETE LITERATURE
CALL TOLL-FREE



StackMaster II

Mount 2 to 8 radios, siren/light controllers, etc. in a single or double stack. No dashboard brace is required. Easily converts to a Data-Base when needed.



DATA-BASE

Mount any North American-made mobile data terminal or laptop, with or without a siren/light controller and/or radio. Includes swivel and tilt with adjustable braking.



GAMBER-JOHNSON

801 Francis Street, Stevens Point, WI 54481
1-800-GJ-MOUNT (1-800-456-6868)



Circle (73) on Fast Fact Card

Here's *one*
Trade Show
which will allow
your company
to reach
thousands of
buyers of
communications
equipment from
hundreds of
government
agencies

**The
56th Annual
APCO Conference
August 26-30, 1990
BOSTON**

This conference brings together buyers
of communications equipment from:
Police and Fire Departments
9-1-1 Centers
Emergency Medical Service agencies
and hundreds of other city,
state & local government agencies.

For more information contact:

Ann Armitage at APCO,
800-824-1850

From Florida or Canada use 904-427-3461

Fax: 904-427-6307

Circle (74) on Fast Fact Card

Calendar

January

29-30—American SMR Network Association Winter Meeting and Exposition, Hyatt San Antonio, San Antonio, TX. Contact: 202-331-7773.

February

5-7—Cellular Telecommunications Industry Association 1990 Winter Meeting and Exposition, Ballys, Reno, NV. Contact: 202-785-0081.

19-22—Gulf Coast Regional Associated Public-Safety Communications Officers, Landmark Hotel, Metairie, LA. Contact: Glen Dastugue, 504-349-5300.

March

11-14—Energy Telecommunications and Electrical Association '90, San Antonio Convention Center and Hilton and Marriott hotels, San Antonio, TX. Contact: 214-235-0655.

20-22—Western Regional Associated Public-Safety Communications Officers Meeting, Doubletree Hotel, Albuquerque, NM. Contact: John Brown 505-888-8123 or Gigi Baca, 505-768-2410.

28-30—International Mobile Communications Expo, Dallas Convention Center, Dallas. Contact: 303-220-0600.



CADEX BATTERY ANALYZER AND REJUVENATOR



Battery
Maintenance

C6000 SERIES
WORKSTATION

- Services up to 2000 batteries per month
- Processes 16 different battery types simultaneously
- Automatically rejuvenates NiCd's affected by "memory"
- Prints battery labels or reports (with printer option)
- Assures confidence in rechargeable batteries

CADEX ELECTRONICS INC. 7418 6th St., Burnaby, B.C., Canada V3N 3L6
Specializing in Battery Maintenance Systems Tel: (604) 522-8046 Fax: (604) 522-1867

Circle (75) on Fast Fact Card


SACHS/FREEMAN ASSOCIATES, INC.

 1401 McCORMICK DRIVE
LANDOVER, MARYLAND 20785

Radio, Telephone, and
Information Systems Consultants
STANLEY I. COHN
SENIOR VICE PRESIDENT PHONE (301) 925-9400

GE PORTABLE SERVICE

- FAST TURN
- WARRANTY
- \$32.00 hr / 2 hr. MAX
- PARTS GE LIST
- RETURN UPS PAID



Smith Communications Service
2121 PARRISH AVE.
OWENSBORO, KY 42301
502-683-0936


PORTA-TECH
**PORTABLE
TECHNICAL
SERVICE, INC.**

1106 Laxton Road • Lynchburg, VA 24502



GE Portable Radio Service Depot
Factory Approved Nationwide
• Current Product Lines
• Voice Guard Certified
• Public Service Trunking
• Surface Mount Technology
(804) 239-3049

 FACTORY TRAINED
TECHNICIANS
FOR QUALITY SERVICE

RETCOM, Inc.

 1425 Greenway Drive / Suite 355
Las Colinas, Texas 75038
P.O. Box 166138 / Irving, Texas 75016
Phone: 214 / 550-0320

Jon Stewart
President

Marketing Research
Management Consulting

Consultation Services

Lightning Protection • Power-Data Line Conditioning
Grounding • Electromagnetic Compatibility
Over 40 years experience, work guaranteed

Roy Carpenter
Chairman and CEO

Lightning Eliminators and Consultants, Inc.
6687 Arapahoe Rd., Boulder, CO 80303
(303) 447-2828 • FAX (303) 447-8122 • Telex 379 1984 LEC

COMMUNICATIONS CONSULTING SERVICES


10 Woodbridge Center Drive
Woodbridge, NJ 07095
(201) 636-6970
Toll-Free (800) 247-4796 • FAX (201) 636-7260

**COMMUNICATIONS
CONSULTANTS, INC.**

Offices in: Boston, Massachusetts, Detroit, Michigan, Richmond,
Virginia, Phoenix, Arizona, Honolulu, Hawaii

YOUR CARD HERE

reaches 63,661 prospects
for as low as \$76 per insertion.
Call 303/762-1249.



Carla Gamino
Classified Advertising Manager

Cellular Business
Mobile Radio Technology

333 W. Hampden Ave., Suite 606
Englewood, CO 80110

(303) 762-1249
Fax: (303) 762-0069

CALIFORNIA LINK

PSION HAND COMPUTER
CONTACT: PRASANNA PERIES

5021 ATLANTIC AVE., #47 • LONG BEACH, CA 90805
(213) 428-1964 FAX (213) 428-1964

JAMES H. BAKER
Executive Vice President

3025 Hilyard Street
Post Office Box 5446
Eugene, Oregon 97405
Phone 503/465-8441


**FOREST
INDUSTRIES
TELECOMMUNICATIONS**

The Forest Industry's Voice Before the Federal Communications Commission

Stuart Meyer
LAND MOBILE CONSULTANT

2417 NEWTON ST.
VIENNA, VA 22180
(703) 281-3808

FCC CALL
K883540

MCCON

Mobile Communications Consulting
S. R. McCnoughy, PE
Principal

13017 Chestnut Oak Drive
Gaithersburg, MD 20878 (301) 926-2837



RAYMOND C. TROTT
CONSULTING ENGINEERS, INC.
1425 GREENWAY DRIVE, SUITE 350
IRVING, TEXAS 75038
214/590-1811

RAYMOND C. TROTT, P.E.
PRESIDENT

LAND MOBILE • MICROWAVE COMMUNICATIONS SYSTEMS

FREDERICK G. GRIFFIN, P.E.
PRESIDENT



FREDERICK G. GRIFFIN, P.C.

A Professional Communications Engineering Firm

3229 WATERLICK ROAD
LYNCHBURG, VA 24502

NO. 257-2044



OMNICOM, Inc.
TELECOMMUNICATIONS ENGINEERING

GENE A. BUZZI
PRESIDENT

WOODCREST OFFICE BUILDING
325 JOHN KNOX RD. (SUITE 1) 204
TALLAHASSEE, FLORIDA 32303
PHONE (904) 396-3180



Carla Gamino
Classified Advertising Manager

Cellular Business
Mobile Radio Technology

333 W. Hampden Ave., Suite 606
Englewood, CO 80110

(303) 762-1249
Fax: (303) 762-0069

HERB SACHS, CONSULTING

Specialist in Public Safety Communications

P.O. Box 729
Bowie, MD 20715
301-464-4268



(517) 351-3252

R. James Evans
President

Evans & Evans Associates, Inc.
Communications Consultants

2803 Southwood Drive
East Lansing, MI 48823

Let MRT introduce you to 63,661* mobile communications professionals...

for as little as \$76!

To display your business card in *MRT's Professional Services Section*, call Carla Gamino today, at **(303) 762-1249**.

*Harvey Research Organization, Rochester, NY

C lassified

Advertising rates in **Mobile Radio Technology's** Classified Section are \$64.00 per column inch, per insertion, with frequency discounts available. There is a one inch minimum.

Ads larger than one inch are sized in 1/4-inch increments and billed accordingly, as determined by total size of the ad, including ruled borders and rounded up to the nearest 1/4 inch.

Blind box ads (replies sent to **MRT** for forwarding) are \$30.00 and Fast Fact reader service numbers are available for \$25.00 per service, per insertion, to cover processing and handling costs.

Optional color, determined by **MRT** on an issue-by-issue basis, is available at \$150 per insertion.

A prepayment discount of 5% is available for all 6x or larger frequency classified advertisers who prepay their full 12 month schedule.

No agency discounts are allowed for classified advertising.

Contact Carla Gamino at (303) 762-1249 in Denver to place your classified ad, or send your classified advertising materials and order to **Mobile Radio Technology**, Advertising Department, P.O. Box 12901, Overland Park, KS 66212.

Help wanted

CELL SITE TECHS SWITCH TECHS

National Openings for experienced Cell Site Maintenance Technicians, Switch Techs (EMX 2500, 500 desired). But will consider any comparable switch training & exp. Locations in a number of expanding markets.

LAWRENCE PERSONNEL
Box 10M
King of Prussia, PA 19406
215-783-5400 (Voice)
215-783-6008 (FAX)

**COMMUNICATIONS RECRUITMENT
SINCE 1957.**

RF ENGINEER

ECS, a leader in Professional Recruiting to the RF communications industry, now has several positions available throughout the U.S. Sales, Marketing and Engineering opportunities. Hardware and software specialists needed. Many managerial positions available.

Please send resume with salary requirements to: **ECS, 2500 Marconi Ave., #306, Sacramento, CA 95821, Or call: (916) 973-8701.**

NATIONWIDE SOURCE for

- Locating available Management, Marketing and Technical Personnel.
- Professional Personnel Placement.
- Search and Recruit.

PRO PLACEMENT
(606) 491-5410

10 West Fourth Street Newport, Kentucky 41071
Serving the personnel needs of the Electronic Communications Industry.

CAREER OPPORTUNITIES

RF Design
H.W./S.W.
Field Engineers
Production Engineers
RF Systems
Project Managers
Radio Field Techs
R&D Mobile Communications
Field Managers

II MORROW INC., Oregon based manufacturer of Navigation and Communication Systems. Explore our challenging opportunities today.

Send letter and resume to:

II Morrow Inc.
P.O. Box 13549
Salem, OR 97309
Attn: Recruiting Dept.

COMMUNICATIONS TECHNICIAN

A Southern California M. S. S. needs to replace a key employee who is about to retire. **NEEDED**, Senior R.F. Technician with experience in maintaining Motorola F.M. Repeaters. Excellent pay and benefits to that right person. Send Resume to:

Ray Russell
Hendrix Electronics Inc.
P. O. Box 506
Imperial, CA 92251
(619) 352-7300

COMMUNICATION TECHNICIANS WANTED!

Parkinson Electronics, Inc., is currently seeking experienced technicians. Must be familiar with GE and Motorola. Must be proficient in customer relations. FCC license or certification required. Qualified Applicants submit resume and salary history to:

Parkinson Electronics
P.O. Drawer 1622
Levelland, Texas 79336

PAGING SYSTEMS SPECIALIST

U.S. West Paging Inc. a division of U.S. West New Vector is looking for a self-motivated individual to maintain equipment in the state of Oregon. Candidate will be home based in the city of Portland. The person should be familiar with PURC and Quintron base station repair as well as have good working knowledge of paging terminals such as BBL and Commonwealth. FCC or NABOR certification is required. Applicant should have a clean driving record and be eligible for an Oregon state driver's license. Excellent benefits package.

Please send resume and salary requirements to:

Attn: Mike Anderson
Regional Manager Technical Services
U.S. West Paging, Inc.
50 116th Ave. S.E. St. #111
Bellevue, WA 98004

RADIO TECHNICIAN WANTED

One of the largest MSS in Southern California needs technicians for repair of two-way radios, base, mobiles, and portables. Requirement: 5 yrs experience on Motorola equipment. Complete benefit package and excellent salary for the right person. **Send resume to: Advanced Electronics, 18220 S. Broadway, Gardena, CA 90248. Attn: Bob Moayeri.**

MANUFACTURER REP COMPANY

Looking for sales people in Florida and Georgia to call on two-way shops. Technical background desirable.

CEMCO
(303) 753-6777

SOUTHERN CALIFORNIA OPENINGS

RADIO TECHNICIANS

Mobile two-way radio background. Proficient with Motorola, GE and/or Johnson equipment.

RADIO INSTALLERS!

Experience in installation of two-way radios in vehicles.

ENGINEERS

Telecommunications or related experience. Land mobile radios and/or microwave engineering. Able to plan new facilities for telecommunications use. Excellent written and verbal skills needed.

Excellent positions with top rates in the industry. Please send resume and call:

H.L. YOH Company
P.O. Box 55698
Sherman Oaks, CA 91413
Mike Parente or Fred Hall
(818) 906-3100

**TWO-WAY TECHNICIAN
IMMEDIATE OPENING**

Shinwa Communications of America, Inc., is seeking experienced two-way technicians. Applicant should have working knowledge of handheld, mobile and paging servicing. Pager experience a plus. Salary negotiable. Send resumes to:

**SHINWA COMMUNICATIONS
OF AMERICA, INC.**
ATTN: PERSONNEL
P.O. BOX 26407
OKLAHOMA CITY, OK 73126

FAX: 405/236-8151
PHONE: 800/627-4722

Specializing in

**SERVICE
MONITORS**

since 1973

- Repair & Calibration
- Buy, Sell and Trade

Don Simon or Mary Jane Bryan

(800) 288-8223

**Communication
Instruments™**

356 Hillcrest Street, El Segundo, CA 90245
Phone (213) 322-3666 — FAX (213) 322-7114

B~D CRYSTAL

Subsidiary of

Hy-Q International

- Communication Crystals
- Pager Crystals
- Channel Elements
 - Recrystallized
 - Compensated
 - Complete Elements

**48 HR. SERVICE
AVAILABLE**

(606) 283-5000

FAX (606) 283-0883

1438 Cox Avenue
Erlanger, KY 41018
(Greater Cincinnati Area)

Precision Quality Quartz Crystals
Made To Your Specifications

Circle (96) on Fast Fact Card

Equipment for Sale

MOTOROLA Radius

Looking for a few select agents
New and Used
Radios and Pagers

**KING•MAXON
GE•MIDLAND
MOTOROLA**

Colorado Hi-Tek, Inc.
4420 W. Highway 160
Pagosa Springs, CO 81147
303-731-5100
FAX: 303-731-5800

Circle (97) on Fast Fact Card

MAXAR 80 & MAXARS For Sale!

U.H.F. 15 & 30W PL or DPL
New Housing, New Bracket,
New Power Cable, Mint!!

\$245 - \$345

800-231-0103

BUY • SELL • TRADE

FREE LIST

USED TWO-WAY RADIO

1-800-826-4413

(916) 527-5363

Communications Equipment Brokers

14810 Pepper Tree Lane

Red Bluff, CA 96080

(BBS) 916-527-4274 (300, 1200, N81)

Circle (98) on Fast Fact Card

**40% OFF
MOTOROLA RADIUS
(805) 497-2397**

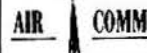
USED 2-WAY RADIOS

Call Sid Cohen

at AIR COMM—Phoenix, AZ
(602) 275-4505 • Fax (602) 275-4555

30%-70% savings on Motorola, GE, EFJ mobiles, base stations, portables, pagers, repeaters—primarily solid state—all frequency bands. Also, accessory items: Motorola "Systems 90" control heads. PL and paging needs, channel elements.

Cash quotations made for purchase of above equipment.



4614 E. McDowell Rd.
Phoenix, AZ 85006

**USED PAGING EQUIPMENT
Motorola & NEC Pagers**

Also, chargers and other used communications equipment. Buy & Sell Equipment. Call D. Doyle for information.

(817)640-2913

**TRANSCON
TC 105**
the Affordable **NEW**
DUPLEX MOBILE PHONE

Dealer Price
\$999.00

MTS
IMTS
DTMF,

(overdial) small type other features available...

1-800-882-3332

U.S. Distributor



SALE
INC Wholesale Distribution



® "Stripes of Quality"

distributed by

**Communications
Associates Inc.**

(800) 435-9313

In Illinois (800) 892-1611

Circle (99) on Fast Fact Card

Classified

Equipment for sale

UNtenna

Low Profile Antenna
for Radio
Communication



Illustrated: Dual Band,
VHF/UHF Model CRX2/4A

FEATURES:

- Higher "Q" than whip antennas
- 95% Height reduction
- Models available from 27-900 MHz (HF, VHF & UHF)

COM-RAD INDUSTRIES P.O. Box 554
Grand Island, NY 14072-0554
Free Brochure Call (716) 773-1445

MOTOROLA CENTRACOM I & II

Console components
BOUGHT & SOLD
Telecommunications
Engineering Associates
409 Wildwood Dr.
So. San Fran., CA 94080
Ph: (415) 871-4200

Circle (100) on Fast Fact Card

IMTS ENCODER/DECODERS

16 areas with different: 1-9 digit ANI, 32 channel scan, timing data.
32 fifteen-digit chainable speed-dial numbers.

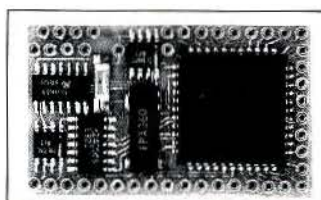
NEW! FOR PORTABLES

Same features
for both boards

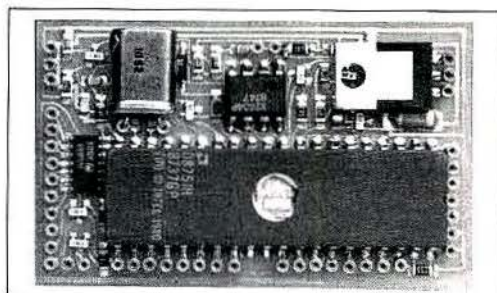
Easy 12 key operation
DTMF sidetones/overdial
Last number redial

Keypad programming
EEPROM memory

Microphone keypad
option
Works with all terminals
Duplex/Half duplex
Horn/Call outputs
Engineering/Install
service



1.70 in. x 1.00 in. \$230.00



2.64 in. x 1.57 in. \$190.00

(503) 343-5227

Fitzhugh & Waggoner, Inc. 1051 W. 11th, Eugene, OR 97402

Circle (101) on Fast Fact Card

Clean Equipment, Low Price

Most units sold with accessories Guaranteed Working. The following list of Models we generally stock. Call before ordering, stock varies almost daily. We buy/sell Used Motorola & GE Mobiles, Bases & Repeaters.
We do not deal in Portables, Pagers or Parts.

L = 30-50MHz V = 150-170MHz U = 450-470MHz S = 800MHz PL = Private Line DPL = Digital PL CG = Channel Guard CS = Carrier SQ
Mot MSR-2000 Base/Repeater L/V/U 45-110W CS/PL/DPL 1-4Fq from \$995
Mot Micor Base/Repeater L/V/U 45-330W CS/PL/DPL 1-4Fq from \$995
Mot Mocom 70 Base L/V/U 25-100W CS/PL/DPL 1-4Fq from \$395
Mot Mitrek Base L/V/U 30-110W CS/CG/DPL 1-8Fq from \$495
GE Ex II Base L/V/U 30-60W CS/CG 1-8Fq from \$295
GE Master II Base/Repeater L/V/U 35-250W from \$995
Mobile Eq
Mot Mocom 70 L/V/U 25-110W CS/PL/DPL 1-4Fq from \$150
Mot Micor L/V/U 45-110W PL/DPL/CS 1-12Fq from \$195
Mot Mitrek L/V/U 30-110W CS/PL/DPL 1-4 Fq from \$295
Mot Syntor L/V/U 35-110W CS/PL/DPL 1-99Fq from \$295
Mot Pulsar II VHF/IMTS/Bell Phones from \$595
GE Master II L/V/U 40-100W CS/CG 1-8Fq from \$150
GE Ex II L/V/U 35-100W CS/CG 1-8Fq from \$150
GE MVP L/V/U 5-50W CS/CG 1-4Fq from \$150
GE Phoenix V/U 20-45W CS/CG/DCG 2-16Fq from \$195
GE Centura 800 conventional/MK-5 Trunking 15W from \$195

BARNETT ELECTRONICS

8718 Wilhite Lane • N. Little Rock, AR 72116
(Orders & Bids Only) 800-423-3858 • (Others) 501-835-7066



Bob Barnett

FOR SALE:

VHF Mostars, 40 watt, PL or DPL, 2 channel, MINT!! \$295
UHF Mitreks, 50 watt, PL or DPL, MINT!! \$470

1-800-231-0103

COMMUNICATIONS HOTLINE BBS

LOCATE USED EQUIPMENT FAST
FREE 24 HOUR AD POSTING
DEAL DIRECT • NO BROKER FEES
UP-TO-DATE • EASY TO USE!
717-751-0626 (2400, 1200 N81)
RD 9 BOX 30, SOUTHVIEW DR., YORK, PA 17402

BUY - SELL RADIOS NEW & USED

Johnson - Motorola
Standard - Uniden
Buy-Comm-Co.
Steven Kenney

(602) 870-4121
FAX # (602) 829-6821
2340 W. Columbine
Phoenix, Arizona 85029

ELENEX CRYSTALS

FOR RADIOS PAGERS

ALL MODELS
COMPETITIVE PRICES

CALL: 1-800-356-8433
FAX: 1-716-534-5950

ELENEX, INC.
7 WAYLAND ST.
N. COHOCTON,
NY 14868

EXTENDED LOCAL CONTROL FOR EFJ 86XX CONTROL STATIONS

Full System and Group select and display,
duplex audio, multiple control points.
Uses 8-conductor cable.

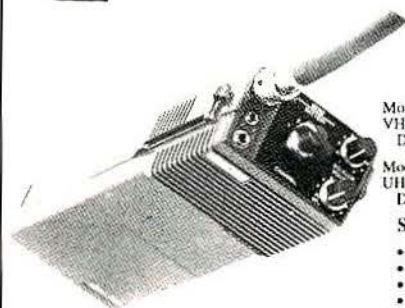
For ordering or more information contact:

Mark C. Bitting, Inc.
99 15th St. - P.O. Box 13
New Cumberland, PA 17070
(717) 774-7203



HIGH PERFORMANCE LOW COST HANDHELDS

FULLY SYNTHESIZED



Model 6011:
VHF 6 Channel Commercial
Diode-matrix programmable \$209.00

Model 6013:
UHF 6 Channel Commercial
Diode-matrix programmable \$219.00

STANDARD ACCESSORIES:

- Flexible Antenna
- 500 MAH Battery Pack
- Wall Charger
- Belt Clip
- Carrying case
- One Year Warranty

OPTIONAL ACCESSORIES:

- Speaker-Microphone \$32.00
- Desk Top Charger \$59.00
- Extra Battery Pack \$32.00
- Superstick Antenna \$18.00
- Extra Wall Charger \$ 6.00
- DC Charging Cord \$ 5.00
- Plugs into cigarette lighter
- Waterproof case \$19.00
- CTCSS (encode) installed \$40.00
- CTCSS (encode/decode) installed \$55.00
- Swivel belt loop set \$15.00
- SERVICE MANUAL \$12.50
- Leather case \$28.00

Dealer inquiries for quantity pricing welcome



A Generation of low cost
High Performance Radios

DELCOM RADIO LTD

Arnold J. Vavken
Export Manager
1340 Orange Ave.
San Carlos, CA 94070

PHONE: 415/592-8790
FAX: 415/593-2680

Circle (102) on Fast Fact Card



*Your Resource for
Communications Equipment
and Technical Support*

Serving the Northwest,
Alaska & the Pacific

515 KIRKLAND WAY • KIRKLAND, WA 98033
(206) 827-7449 • FAX (206) 827-7189

Circle (103) on Fast Fact Card

Channel Elements on Any Frequency \$17 with Trade-in or \$25 without Trade-in MICOR, MOCOM & MOTRAC

Call toll free: 1-800-237-9654 (except in Louisiana)
1-504-363-4006 (in Louisiana)

We ship within 3 working days!

CHANNEL ELEMENT HEADQUARTERS

2320 South Friendship Dr., Harvey, LA 70058
We specialize in hard-to-find frequencies.

NEW NEW	494MHz	NEW NEW
SC75UAS89D 90 Watt Remote/ Repeat, less cabinet		\$3,600
N8A104/N3A128 90 Watt Local/ DC Remote Desk Top		1,465
N8A102/N3A128 90 Watt Local/ Control Desk Top		1,285
N8A103/N3A121 35 Watt Local/ DC Remote Desk Top		1,155
N8A101/N3A121 35 Watt Local Control 16 Ch Desk Top		900
N3B128/S9A111 90 Watt Mobile 128 Ch Scan Accessories		850

RECONDITIONED POWER SUPPLIES/PA'S

MASTR II 110 Watt 30A PS	150
MASTR II 75 Watt 18A PS	75
DELTA 19A704647P1 12A PS	40
DELTA 19A704647P2/P3 13A PS	85
19D430488G2 800 MHz 30Watt PA	325
19D432307G5 800 MHz 80 Watt PA	350

NEW LONDON TECHNOLOGY, INC.
231 Old Timberlake Road
Forest, Virginia 24551

804-525-0068 FAX 804-525-0078

TEST EQUIPMENT FOR SALE

Motorola 2008D (cellular & 2-way
compatible)

Motorola R1801 programmer (w/
portable adapter)

3 Months Warranty From Motorola

Kenwood Oscilloscope & More

Comm Enterprises Inc.
(303)936-1122

COM-SIG ON GLASS ANTENNAS FOR CELLULAR AND SMR



Unbelievable Prices!
Quantity Discounts

Communications Signalling Inc.
17223 Sierra Highway #105 & 106
Canyon Country, CA 91351
(805) 251-2244

Outside Calif. (800) 423-2565
FAX: (805) 252-3100

Call Mike Winkler

D&L CONNECTIONS

Buy, Sell & Service GE Two-Way Radios

- Less than wholesale prices
- One million dollars of GE equipment
- Same day shipping
- Express Repair power



1-800-3366-VAL

IN INDIANA: 1-800-334-9653
FAX # 1-219-483-5584
3512 CAVALIER DRIVE
FURNI WAYNE, IN 46808

MOTOROLA 40% DISCOUNT 1-800-359-0918

MOTOROLA FOR SALE

STX Portables with charger ... \$595-\$895
Privacy Plus 500 and 1000 units ... \$595
and \$850, MINT!!
Spectra 900, 32 fq. w/dual smart net.
As New ... \$595

1-800-231-0103

FAX IT FOR LESS!

GUARANTEED LOWEST PRICES!

All Major Manufacturers
1-800-345-FAXX

Dealer Inquiries Invited—Quantity Discounts
Fax Switch and Fax Paper Available
MC/VISA Welcome
Business Wholesale Ltd.

THIS MONTH'S SPECIALS:

General Electric CF2000 Carphone
Handsets Spec: \$35
Motorola MX350 Portable Model H43AAU3140
Hiband, 4 freq., 6 watt w/PL Spec: \$325
Many GE boards and complete catalog available



Call (201) 489-9000

GREGORY ELECTRONICS CORP.

249 Route 46, Saddle Brook, N.J. 07662

Equipment for sale

VersaTel

COMMUNICATIONS

BUY - SELL - TRADE

Most Makes and Models

CALL FOR OUR
SPECIAL ON GE
UHF DELTA MOBILES

1-800-456-5548

800 MHz Mobiles

800 MHz Transceivers at Below Factory Prices!

Completely integrated Full Duplex 800 MHz, 30 Watt mobile, trunk mounted transceiver. Connector ready for Glenayre 2020/21 Control Head. The transceiver features rugged, reliable construction in a 8"x3"x9" package. Quantities in stock. Call Communications Products of Nevada for pricing and immediate delivery.

702-877-3180

Circle (104) on Fast Fact Card

**GC GENERAL
COMMUNICATIONS**



**MOBILE COMMUNICATIONS
AUTHORIZED DEALER**

#1 GE DEALER IN THE USA!

Largest Inventory — Quality Service

Fastest Delivery and Best Prices



1-800-356-3200

5157 Anton Dr.
Madison, WI
53719

Circle (105) on Fast Fact Card

NEC IDP 5300 PAGERS

Frequencies in stock: 152.480,
152.0075, 152.240, 152.840, 157.800

McManus Communications

(501) 763-6250
FAX: (501) 763-6533

USED PAGERS

Motorola and NEC. Reconditioned on
your channel w/warranty or as is.

ACS (303) 337-4811
FAX (303) 337-3084

AA ALKALINE BATTERIES

Discount prices for low volume users

Box of 75 only \$36.00

Box of 150 only \$64.50

Box of 300 only \$126.00



Prices include all shipping charges
within the continental USA!

(713) 621-3566 ext 12

Replacement Batteries

Centurion's full line of batteries to fit leading models perfectly.

For Two-Way Radios and Cordless Telephones

■ Motorola ■ GE ■ Uniden ■ Maxon ■ King

■ Midland ■ Cobra ■ AT&T ■ Radio Shack ■ Sanyo

For a distributor nearest you, please call

Toll Free 800-228-4563; or toll free fax 800-848-DUCK (3825)



P.O. Box 82846 ■ Lincoln, NE 68501

Circle (106) on Fast Fact Card

**COOKS
COMMUNICATIONS
CORP.**

(Authorized Dealer)

GENERAL ELECTRIC

Mobile Radio

**GE MOBILE AND PORTABLE RADIOS
AT WHOLESALE PRICES**

160 N. BROADWAY
FRESNO, CA 93701

1-800-233-8818

Circle (107) on Fast Fact Card

PARAMOUNT

Communications/Electronics

Motorola Reeds, Beepers and Channel Elements

Pro-Am Antennas and Optoelectronic

Frequency Counters



Distributor

Buy, Sell or Trade



800/431-7777



506 Burnett Ave.
Dalton, Ohio 44618

M. Clouston
216/828-2071

Fax: 216/828-8308

WE BUY AND SELL USED MOTOROLA AND GE FM TWO-WAY RADIOS

1 SYNTOR X Base, 800 MHz Trnk., L35VUB5174AM
4 MT500, 460 MHz, H34BBU3124
10 MOTRAC Comm. Rptr., 460 MHz, C74MSY3101
4 HT440, 460 MHz, H34LCU3124
63 MT500, 155 MHz, H33BBB3184
2 MH10, 48 MHz, H31RPU3120
3 MICOR Base, 37 MHz, B91RCB3496
60 MICOR, 37 MHz, T71RTN3490
3 MH10, 37 MHz, H31RPU3140
1 MICOR Base, 31 MHz, B91RCB1196
5 MT500, 31 MHz, H31BBU1144
14 MITREK, 31 MHz, T81JA290
SCHAEFER RADIO CO.
3101 Grant • P.O. Box 388
Denver, IA 50622 • 319/984-6115

RADIO GATED REPEATER MAKER DGRM-501

The DGRM-501 provides repeater operation with use of most any two transceivers. Repeater crossband and link operation. Digital gate circuit for positive control. Ideal for remote locations, Extremely low power.

\$89.00

Call Dave or Shane Camky
ORDER 1-800-283-5158
OFFICE (503) 673-2678
FAX (503) 673-5049

RADIO DELAY OFF TIMER DG-101, DG-105, DG-108

Provides control of radio with delayed shut down after ignition is turned off. Provides normal Tx/Rx during delay time. Three factory stock delay times are available: 1-2, 3-5, 7-9 hours. (Custom delay times available).

The DG-100 series device eliminates battery failure due to leaving mobile, cellular, trunking and marine radios, or any other equipment on inadvertently.

\$28.00

*Tested and proven on fleet, government, police and fire service vehicles. *1 year warranty.

CRYSTALS

FOR ALL RADIOS
□ CHANNEL ELEMENTS □ BATTERIES
Recrystallized & Compensated For Portables & Pagers
□ MONOLITHIC CRYSTAL FILTERS

EMERGENCY SERVICE
FOR CRYSTALS 24 Hours / 72 Hours / 1 Week
Normal Delivery 3 Weeks

Competitive Pricing!!!

800-333-9825

CAL CRYSTAL LAB, INC.
1142 No. Gilbert, Anaheim, CA 92801 FAX 714-91-9825
HIGH QUALITY, TIGHT TOLERANCE CRYSTALS



AAA COMMUNICATION MANUFACTURERS

Post Office Box 20 • 5407 North East Stephens
Winchester, Oregon 97495

Circle (108) on Fast Fact Card



FOR SALE

2- GL-2000 control heads \$100 ea.
NEC Model TR5E20-1A SMR full duplex
transceiver with EZ1120-1B control head - \$200
IDA Model 40-10 Interconnect - \$100

CSC 1-800-237-1840

MOTOROLA RECONDITIONED RADIOS

Hundreds IN STOCK!

800-231-0103

JANUARY SPECIALS

BASE STATIONS CALLS\$S

C24RCB Micor 12 watt UHF repeater C71RTB Micor 30-36 base
C44RCB Micor 45 watt UHF repeater C71RCB Micor 42-50 base
C53RCB1105 Micor VHF base NEW! C70SSG 2.0-18mhz SSB STN
C53RTB Micor 60W VHF base
Motrac 100W UHF base; Make good ham repeater
VT85UAS88 GE 350W 42-50 base

PAGER CHARGERS SINGLE UNIT!

NLN-1147A Pageboy 2\$10 NLN-9580 Sensor\$10
NLN-4508B Spirit\$10 NRN-4953A Minitor\$10
NLN-4412A Minitor\$10 NRN-4273A\$10
NLN-9419B Pageboy 3\$12

PAGERS

A03FNC Page Boy II T&V VHF, A01BGB2568 BPR2000 T&V 35.22mhz
A19BGB4661 BPR2000 DSPLY35.22mhz !! CALL !!

MOTOROLA T1600 OPTION BOARDS:

TRN-6859 DC F1-F2-PL/PS\$45 TLN-1640 DTMF EnCDR\$55
TLN-5059 Digital dial\$75 TLN-4870 Tone control\$70
TLN-4985 Phone patch\$30 TLN-5418 Switch/w 3 leds\$30
The following switch cards begin with TLN-49XX
37 F1-F2-PL/PS\$45 78 Speaker mute \$25 86 Lot!\$25
38 F1-F2/PS\$40 80 Wild card mod\$25 87 DC Lot!\$45
48 F1-F2 Select\$25 81 Encoder\$25 88 VU Meeter\$35
76 Switch\$25 82 Switch\$20 89 Audio board\$35
77 Alt line SW\$25 99 4F/4PL SW\$75 93 Switch\$25

GENERAL ELECTRIC

N6A32 GE trunked Mark 5 w/ mike\$225
N7D60 GE trunked Mark 5 w/DTMF pad & hand set\$225
CT56FAG66 GE MVP Mobile 150-162MHX\$175
19C327626G1 MVP Channel guard board NEW!\$50

MOTOROLA MSR BASE STATION CARDS

TRN-5098 R1 Audio\$35 TRN 2443 Guard Tone\$55
TRN-5236 Line driver\$35 TRN-5324 Squelch gate\$35
TRN-5078 PL Module\$75 TRN-5239 Paging DC TFR\$45
TRN-5076 DPL Module\$75

MISCELLANEOUS

45 NLN-7419A Tuning tool kit for HT90/4402/\$1
20 NLN-7407 HT90/440 DPL Deck NEW!! NEW!!\$25
15 19D413522G4 GE PE/PY 7.5V 900ma NEW!! NEW!!\$25
NEW NLN-6167A Motorola MT-HAT Omni Standard NI-CAD\$20
Pulsar T-1092 Tone Remote Adapter for IMTS BaseCALL!!
NTN-4864 Radius P100 Single unit rapid charger NEW!\$46
TLD-8633 Micor VHF 100W PA Board less XZISTORS NEW!\$50
TLD-8620 Micor power control board\$25
L-1158 MRTI Interconnect \$175 / TLE-8965 Micor UHF LL Amp\$25
TLN-4413 Console/ette 4F switch kit\$10
TRN-6091B SQIM for Spectra TAC Voter\$45

We Have And Are Looking For Paging Stations And Pagers T&V; 5/6;
Display; All Bands. Call For Quote!!!

!!!Our New Direct Order And Information Number!!!



Leavitt Communications, Inc.

5115 Church Street Skokie IL 60077-1288
Phone 708/676-8282
FAX 708/982-0223

Circle (110) on Fast Fact Card



COMMUNICATIONS, INC.

MANUFACTURER OF
DC/TONE REMOTES—SIGNALLING PRODUCTS

WARRANTY/REPAIR OF
COMMUNICATIONS PRODUCTS, INC.
EQUIPMENT

505 N. BOWSER 1-214-437-5320
RICHARDSON, TX 75801 FAX 1-214-437-5360
1-800-869-9128

GE Mastr-II DTMF Decoder

- 1-11 digits: all, group, selective call
- 8 programmable, versatile features
- Timed automatic reset
- Decoder lockout
- Hookswitch input
- Programmable Channel Guard encoder
- FET outputs
- Low power CMOS
- Transpond tone & PTT output
- Built-in self-test
- 2.5" x 3.5" x .6"
- Fits Channel Guard connector



Sierra Digital

5675 Spyglass Ln Citrus Heights, CA 95610 (916) 966-7776

Circle (109) on Fast Fact Card

Classified

Equipment for Sale

Swersweep SWR Measurement Kit

Swersweep is designed to work with modern service monitors with tracking generator and spectrum analyzer enabling a plot of SWR vs. Frequency on the CRT display. Swersweep allows the instrument to function as a scalar network analyzer. See feature article on page 64 of October *Mobile Radio Technology* for more information.

Uses:

- Tuning Antennas: Base, mobile, or glass
 - Tuning cavities, duplexers, or filters
 - Tuning preamps and Receiver front ends
 - Checking transmission line and trimming to resonance
- Each Swersweep is hand built with calibration traceable to the National Bureau of Standards.

1-500-Mhz \$350, 1-1000 Mhz, \$675

Allos 25 working days for delivery. Prices include shipping.

Europa Marketing
Phone: 602-345-6666

RADIUS
ALL SYNTHESIZED MOBILES IN STOCK
ALL SYNTHESIZED PORTABLES IN STOCK
CALIFORNIA RADIO
800-231-0103

LORAIN

24 volt, 50 amp. charger
RL50F25

(818) 308-0398

**COMPLETE CHANNEL
ELEMENTS ON YOUR
FREQUENCY FOR
\$25 - \$35!!!
ORDERS ONLY:
1-800-237-6519
INQUIRIES AND IN LA:
504-361-5525**

- ☐ Motrac; Micor, Mocom; Mitrek; Etc.
- ☐ Guaranteed to Meet or Exceed OEM Specs.
- ☐ Any desired Frequency available for fast delivery.
- ☐ Lifetime Warranty on Crystals.
- ☐ We give Trade-in credit for your Old Channel Elements

Try us first. We always have your frequency available.

NKX

1814 Hancock St.
Gretna, LA 70053

WE MANUFACTURE NEW
PAGER REEDS FOR

*MINITOR & PAGECOM
ALL FREQUENCIES

\$16.00 ea.

FAST DELIVERY

*TRADEMARKS OF MOTOROLA

Bramco

PH (513) 773-6255

FAX #(513) 773-8003

P.O. BOX 1482, PIQUA, OHIO 45356

CRYSTALS CRYSTALS CRYSTALS

For All Makes of Radios & Pagers

Recrystallizing of your Motorola and G.E. channel elements

Call 800 251-1357

In California 800 824-7766

FAX 213 769-0154

Top quality, ultra high shock crystals.
Expedited delivery service available.
24 hr. 72 hr. 8 day Normal 15 days



**Standard
Communications**

Frequency Management Division
P.O. Box 92151, Los Angeles, CA 90009-2151

Circle (111) on Fast Fact Card

PAGER NAMEPLATES

Your Logo and Company ID Imprinted
• No Minimum Order • No Set Up Charges
also REWARD LABELS
Send for Free Samples
ADVANCE LABEL and TAG
1725 N. McDonald • McKinney, Texas 75069
(214) 542-5345

Centra Com I & Haze Beige Console
For Sale in Parts or Whole

**NORTHEASTERN
COMMUNICATIONS INC.**
1660 E. Main Street
Waterbury, CT 06705
(203) 575-9008



Better Than WHOLESALE PRICES

(Radio Dealers Only)

**GE Mobile & Portable 2-Way
Radios/Telephones/Accessories**



Ask for Freda

Order Today! Ship Today! Double EZ Buying Power!

Choose From: 90 Days Free Transamerica Floor Planning -or- C.O.D.

Earn Cash Back With Our Bonus Buck\$!



3403 Governors Drive
Huntsville, Alabama 35805

1-800-548-2484

Or FAX Your Order: 205-539-1663

"Your Full Service GE Wholesale & Support Headquarters"

Circle (112) on Fast Fact Card

SAVE-SAVE at C.W. Wolfe

BASES/REPEATERS

MOT MICOR C53RTB1103
H.B. Local Control (like new) \$875.00
GE MASTR II UHF Repeater 2800.00
MOT MICOR 44" Cabinets 90.00
GE MASTR II 30" Cabinets 125.00
GE MASTR II 44" Cabinets 150.00

MOBILES

GE DELTA "S", 42-50, 60W,
N.B. 16 ch. all access. 400.00
GE DELTA "S", 42-50, 100W,
N.B. 16 ch. all access. 450.00
Kenwood KT601S, 42-50, 60W,
N.B.Q.T. 16 ch. underdash 350.00
MOT MICOR, 45W, 4 for 8 F.,
136-150 MHz drawer unit only
with all access., 4 for 8 F.
Scanhead 150.00

GE PHOENIX 450 2 F. w/CG

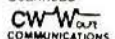
DTMF decoder, DTMF
Mics. \$325.00 ea.
GE PHOENIX "S" H.B.
16 chan., with CG 325.00

ACCESSORIES

MASTR II Access. for ExecII
SX Series 125.00
MASTR II Access. Group 125.00

MISCELLANEOUS

GE PE Portable H.B. 8 F. w/CG 75.00
GE PE 3 Hour Rapid chargers 65.00
Lambda Power Supplies 14 Amp
Continuous Duty 66.00
Redicore DTMF Misc., MITREK,
MICOR, SYNTOR Plugs 20.00



All sales cash or cashier's check. Fax: (406) 252-9617
1113 Central Ave. • Billings, MT 59102 406-252-9220

ELECTRONIC WORK STATIONS

Work benches - anti-static mats & accessories
soldering & desoldering devices - tool kits

**COMPLETE LINE OF TEST EQUIPMENT
INCREASE REPAIR & MAINTENANCE
PRODUCTIVITY**

★ ★ ★ **ALCOM ELECTRONICS, INC.** ★ ★ ★
2801 17th Avenue, Gulfport, MS 39501
(601) 868-6596 • 1-800-476-ALCOM • FAX: (601) 868-0133

★ ★ ★

Circle (113) on Fast Fact Card



We Stock Over 10,000 Items!



Dare To Compare
BULLDOG MADNESS!
MASTER SHOP
Assortment BL-177
was \$349 Now \$199/Includes:

MAD DOG c=100

*"NYLON" insulated butt splices
22-18 GA \$4.49/c, 16-14 GA \$4.49/c,
12-10 GA \$5.94/c

*"NYLON" insulated ring connectors
22-18 GA #8 \$4.89/c, #10 \$4.89/c,
16-14 GA #8 \$4.89/c, #10 \$4.89/c
BLACK HEX head tek screws 8 x 1/2"
\$2.00/c 8 x 1" \$2.49/c

FUSE LINKS 10 GA 30 amp, 74c each

STEEL STORAGE DRAWER \$19.95 each

40 hole steel bin labeled for easy identification
22-18, 16-14, 12-10 GA nylon butt solderless conn.
22-18, GA #6, 8, 10, 1/4 nylon ring solderless conn.
16-14, GA #6, 8, 10, 1/4, 5/16, nylon ring solderless conn.
12-10, GA 10, 1/4, 5/16, 3/8, nylon ring solderless conn.
16-14 GA scotchlok in line fuse taps, auto fuse tabs
10 GA fuse links with 30 amp. fuse
22-18, 16-14 GA nylon solderless conn. 16-14 GA piggy backs
16-14 GA nylon crimp cap solderless conn.
16-14 GA male and female nylon solderless bullet conn.
16-14 GA male and female nylon solderless quick slides
22-18 GA speaker tab quick slides
(BLACK!) Hex head tek screws 8 x 1/2", 3/4", 1"
Bugle head stingers 6 x 1", 1/2", 1"
Pan head tek screws 8 x 1/2", 3/4", 1"
Black nylon tie wraps 4", 7"

OVER 2000 PIECES!

For Quality and Service,
call Bulldog Domestic Fasteners in CA (805) 473-3161
call collect outside CA (800) 843-1364 (800) THE 1DOG

— We give quantity discounts
— All products guaranteed



Circle (114) on Fast Fact Card

Services

SERVICE INSTRUCTION

38 lessons & tests written exclusively for mobile communications servicing. No Radar. No TV. Home Study. \$375. Time payments available. Established 1960.

Mobile Training Institute
528 Pacific Terr. P.O. Box E
Klamath Falls, OR 97601-0021



(503) 882-5408

DUPLEXER RETUNING

24-HOUR TURN AROUND!

Call: (800) 727-5657



Since 1957.

2121 S. TREADAWAY, ABILENE, TX 79602

Circle (116) on Fast Fact Card

Tap into our stock



MOBILE RADIO

also RADIO MOD's
to GE mobiles



- New and used
- Extend/delay HORN HONK
- Make REPEATERS from mobiles
- POWER DOWN mobiles w/timer
- REMOTELY set & know the AREA/GROUP on G-Marc Control Station
- Expand Classic 1 to 8 AREAS
- Repackage V/E interconnect in small rack height



(800) 332-7003

Call!
for catalog
or quotes

Circle (115) on Fast Fact Card

DUPLEXERS RETUNED FAST

ALL MAKES

48 Hr. Turnaround

also

- filter retunes
- isolator retunes
- repairs
- modifications
- double shield cables

We have 17 yrs. experience.

Call Dennis at
(716) 828-0290

CODEN ENTERPRISES, INC.

195 Burmon Drive
Orchard Park, NY 14127

MOTOROLA Radius

Dealer Sales Agents Wanted.

- * Sell Quality Name — Boost Company Image
- * No Investment Required — No Service Headaches
- * Good Commissions — Profitable Program
- * Free Programming — Free Shipping
- * Complete Promotional & Technical Support

800-874-5934



583G Pondella Road
N. Ft. Myers, FL 33903
(813) 997-2299

CLING COMMUNICATIONS INC.

Land Mobile Radio Systems
Design • Construct • Maintain

Take advantage of our
40 years of experience

Tower Sites Available

Cleveland • Toledo • Cincinnati

Saginaw • Detroit

South Bend

216/656-5098

Services

EXECUTIVE TRAVELERS MESSAGING SERVICE

Automated-Secure—24 Hours

Call for messages or leave messages from
any telephone.

For additional information:
1-800-TELESEND
extension demo

NEUTEC SALES AND SERVICE GE SERVICE

We will repair your Neutec mobiles or portables. We are also a service station for General Electric mobiles and portables. Motorola pager repair—flat rate \$35.00. Factory trained service & installation center for Orbacom.

**NORTH SHORE COMMUNICATIONS
SYSTEM**

(201) 291-0400 FAX (201) 291-1815

DUPLEXER TUNING

Minimize your Losses
Maximize your Gains



D P ELECTRONICS, INC.
152 Floyd Avenue
Bloomfield, NJ 07003
(201) 748-6334

"Making The Connection
in Communications"

Classified

Equipment wanted

*****WANTED*****

All late model HEWLETT-PACKARD, TEKTRONIX, WAVETEK, IFR and CUSHMAN electronic test equipment. We buy working or non-working test equipment. **WE PAY CASH! OR LET'S TRADE!**

ALCOM ELECTRONICS EXCHANGE, INC.
2801 17th Avenue
Gulfport, MS 39501
(601) 868-6596 • (601) 896-6596
(800) 476-ALCOM (ORDERS)
FAX: (601) 868-0133 (24 hrs.)
N.I.S.T. TRACEABLE



GET MORE SALES FOR YOUR MONEY WITH MRT CLASSIFIED!

Call or write:
Carla Gamino
c/o MRT
333 W. Hampden Ave., #606
Englewood, CO 80110
(303) 762-1249

LOOKING FOR MOTOROLA TRUNKED RADIOS

STX or MTX 800 Portables
Call: 1-800-274-0087

WANTED
STANDARD COMMUNICATIONS
PG-60 VHF HSC PAGERS
CALL
WEST FLORIDA COMMUNICATIONS
904-433-2533 (24 hours)

**MITREKS
WANTED**
(ALL BANDS)
800-231-0103

REQUEST FOR PROPOSALS LOS ANGELES COUNTY RADIO SYSTEM

Copies Available for
Pick-Up At:
Internal Services Dept.
550 S. Vermont, Rm 200
Los Angeles, Ca 90020

Mandatory Conference on
Jan. 30. Bid Close April 6,
1990. O.E.M.'s encouraged to Bid

\$WANTED\$

Cash + Shipping paid "Promptly"
Motorola, GE,
Bases, Mobiles, Repeaters and
Service Monitors
"NO JUNK"
Pulsar II VHF/Bell Phones
Barnett Electronics
800-423-3858
8718 Wilhite Lane • N. Little Rock, AR 72116

Computer products

IMSITE® The Only Complete Software Toolbox For RF Communications

Complete Package
On Nine Disks,
Including Bound
Manual

- Includes the *fastest* intermodulation programs available for the IBM PC and compatibles...no exceptions
- Includes graphical site documentation and representation
- Includes the only available expert system for interference analysis
- Includes on line tutorials and instructions
- Includes path and propagation analysis and site design including Terrain analysis...real time

\$389.00

Individual Modules
Available

Call
703-268-5400

**Cybersym On line.
Software Support and O.L. Services
703-268-9767, 1200, N, 8, 1**

Used by: US Drug Enforcement Administration
US Dept. of Justice • US Immigration and Naturalization
II Morrow Incorporated • US Army Corps of Engineers
Many State, Local and Municipal Agencies
Consultants and Two-Way Shops

CyberSym Control Systems, P.O. Box 227, Blacksburg, VA 24063

Available by
March 1, 1990
SITEPRO
VECTOR 30

For communications
Engineers
(30 sec data also
available)

Circle (117) on Fast Fact Card

\$275.00

"MICROWAVE"

TCS

\$275.00

"MULTIPOINT"

Quality Microwave and Point-To-Multipoint Calculation Programs

Technical Specifications • Sample Printouts • Information
Technical Communications Software

P. O. Box 884
Montgomery, TX 77356

(Texas: add 6%)

(409) 588-3200

FAX: (409) 588-4434

IT'S NOT WHAT YOU MAKE - IT'S WHAT YOU KEEP !

THE SERVICE MANAGER

*Intelligent software, for managers who take
their service business very seriously !*

by **MICRO-QUICK SYSTEMS, INC**
(714) 980-1034 Fax: (714) 944-3995

Circle (118) on Fast Fact Card

3 Second Digitized
Terrain Data

MICROWAVE ENGINEERING PROGRAMS COMPUTER SOFTWARE FOR PC'S

- PATH PROFILES - REAL TIME
- QUADMAP CROSSOVER POINTS WITH QUADMAP NAMES
- 3 & 30 SECOND TOPO DATA, HAAT CALCULATIONS
- PATH ANALYSIS



ROCKY MOUNTAIN COMMUNICATIONS, INC.
12844 WEST ILIFF AVENUE • LAKEWOOD, COLORADO 80228
(303) 988-3395

COMPUTER SOFTWARE FOR MICROWAVE
ENGINEERING APPLICATIONS

Now
Available!

Tower space

TOWER SPACE

Westchester • Putnam, NY

Newly installed low-loss combiner systems for 150-900 MHz. Bogner antennas 450 and 900 MHz. Elev. over 1,000 ft. Easy access all year. Covers Northern Westchester, Putnam, Rockland and Connecticut.

SIGNAL TOWER COMPANY, INC.
(914) 633-0569

PRIME TOWER SPACE NOW AVAILABLE!

Located west of Cleveland in Amherst, Ohio. Ground elevation: 750 feet. Tower height 290 feet. Two-way radio and microwave availability. Contact:

David A. Laidlaw
COMMUNITY SELECT INVESTMENT, INC.
3600 Kolbe, Ste. 111
Lorain, OH 44053

216/960-4750

Circle (119) on Fast Fact Card

INTERMOD ANALYSIS PC SOFTWARE WITH SITE DATABASE

- Fast - Menu Driven - Report to Screen/Printer
- Enter up to 500 TX & 500 RX Frequencies • Selectable Bandwidth 'Window' Around RX Freq.
- Calculates 2nd, 3rd, 5th, 7th, 9th Order Products

\$79.95 + shipping & tax

RAYFIELD COMMUNICATIONS
858 S. GLENSTONE
SPRINGFIELD, MO 65802
417/864-5960 FAX: 417/864-6837

Circle (120) on Fast Fact Card

COMPUTERIZE your

- **FCC LICENSING**
with quickform 574 (\$495).

- **PRICE QUOTES**
with Minute Quotes (\$495).

Slattery Software (619) 560-0644

Your ad could be HERE

for just \$64

Call or fax:

Carla Gamino

(303) 762-1249

FAX: (303) 762-0069

FREE BEEPER

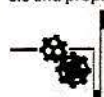
... software for your subscribers sales leads or customers.

Introducing **BCNU**, an end user Beeper Call Number Utility for home or office PC's. Designed for people who use beepers. Call and/or keep track of tone, voice, display or alpha paging activity with creative graphics, printed reports and call counting. BCNU is customized with YOUR company name and sales information, simple to install and use and may be copied and distributed without restriction. A powerful account builder your sales people will love. Disk demo "BCNU"... \$10.00.

Space Mark Communications, Inc.
P.O. Box 30
Hummelstown, PA 17036

ADVANCED INTERMOD PC SOFTWARE - \$175

By popular demand, ver. 2.10, now with site database. Enter freqs. only once, save, recall, edit, do "what if" studies. Time proven since 1985. Select to 9th order, any band width, over 200 Tx and Rx freqs., IF's, etc. Reports in plain English text. User friendly. Free demo disk. Also, TAP-terrain analysis and propagation study software. Auth. dealer. Updates for ver. 1.706 users—\$80.



MECH-ELEC SYSTEMS

(303) 674-1101

TALL TOWER

PHILADELPHIA

925 feet AMSL

40° 05' 00" 75° 10' 47"

AAT COMMUNICATIONS CORPORATION

1854 Hyland Boulevard
Staten Island, New York 10305
Site Division (718) 979-6600

Circle (121) on Fast Fact Card

TEL: (312) 631-9016

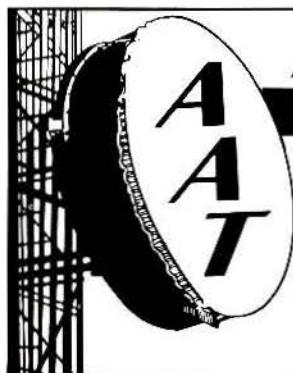


CHICAGO TOWER LEASING CORP
COMMUNICATIONS
TOWER & ANTENNA
SITES FOR THE
METROPOLITAN CHICAGO
AREA

STAN STANN

P.O. BOX 31160
CHICAGO, IL 60631

Tower space



ANTENNA SITES

N.Y., N.J., PA., CT., MD., Del., VA., FL.

Specializing in: acquisitions, management, selection, leasing, engineering, and installation. Concentrating in N.Y., N.J., PA., and CT.

Contact Silvio Marraccini or Jerry Barton
TEL. (718) 979-6600 FAX (718) 351-2525



AAT COMMUNICATIONS CORPORATION

1854 HYLAN BOULEVARD, STATEN ISLAND, N.Y. 10305

Circle (122) on Fast Fact Card

**TOWER SPACE
SOUTHERN CALIFORNIA**

31 sites ranging from Santa Barbara to Mexican Border. Stand-by power.
Ask for Jack Reichler
MERIDIAN COMMUNICATIONS
23501 Park Sorrento, #213A
Calabasas, CA 91302
(818) 888-7000

PRIME SO. CALIF. SITE

KJOI COMMUNICATIONS SITE

The #1 site in the entire Los Angeles Area and the only commercial tall tower on the Santa Monica Mtns. with line-of-sight to all of So. Calif.

Contact: John Davis, Site Manager

(818) 355-6909

CONTINENTAL U.S.

We manage over 140 antenna sites nationwide. We also negotiate new locations for users.

SHAFFER ASSOCIATES
communications consultants

3050 Post Oak Blvd. Ste. 1700
Houston, TX 77056 (713) 621-4499

Circle (123) on Fast Fact Card

TOWER SPACE

Prime sites in Ft. Myers, Naples and Charlotte County. All of Southwest Florida. Sites for two-way, microwave and broadcast antennas. Heights from 400—1,500 feet.

CALL: (813) 939-8900

TOWER SPACE

Prime sites on Catalina Island with state-of-the-art equipment room. Excellent coverage of Southern California Coast.



Catalina Conservancy
Box 2739 • Avalon, CA 90704
(213) 510-1421

Tower services

COMMUNICATIONS SITE DESIGN • SALES • INSTALLATION
SITE LEASING • INSPECTION • MAINTENANCE



DAVID J. MERTENS

PRESIDENT

(602) 940-0371

MOBILE (602) 397-3036 • FAX (602) 961-0868

P.O. Box 1598

Chandler, Arizona 85244

NEED TENANTS??

Advertise your sites in the
**NATIONAL COMMUNICATIONS
SITE DIRECTORY**

Dedicated to advertising antenna sites for lease

NEED SITES?

Then NCSD contains hundreds of prime antenna sites across the Nation.

To get your copy write or call:

INTRA-FAM, Dept. M, P.O. Box 93
Freehold, NJ 07728 (201) 462-5964



Communication
Tower Construction

(409) 755-4038

Maintenance • Installation • Painting

HELICOPTER SERVICE

P.O. Box 8220—Hwy. 69 S
Lumberton, Texas 77711

Fax: 409-755-7409

LUMBERTON TOWER SERVICE, INC.

**SHAFFER TOWER SERVICES
INCORPORATED**

- SHELTERS
- MAINTENANCE
- INSPECTIONS
- PAINTING
- GROUNDING
- ENGINEERING
- CONSTRUCTION
- ANTENNAS LINES
- RELAMPING
- SALES

Complete services for the Land Mobile
Cellular, Common Carrier and Broadcast industries.

(713) 621-4499

3050 Post Oak Blvd., Ste. 1700, Houston, TX 77056

Circle (124) on Fast Fact Card

Cellular services

**COMMISSIONS PAID ON
MIDWEST CELLULAR
ACTIVATIONS**

Illinois, Michigan, Wisconsin,
Ohio and Indiana
Call 1-800-274-0087
to activate!

**PHILA., PA., So. Jersey
\$275.00 Commission**

Professional on-site installation . . . \$125

Warranty service on all brands

ADVANCED CELLULAR OF PHILADELPHIA

800-233-0013 • IN PA 215-322-4600

**HIGH COMMISSIONS
For
SOUTH FLORIDA
ACTIVATIONS**



(305) 666-7428

FAX: (305) 662-5710

Apollo Telecomms., Inc.

9810 S. Dixie Hwy.

Miami, FL 33156

Repair services

Two Way Radio Repair Service

Mobiles & Handhelds

Regency, Wilson, Octagon, Maxom, etc.

- References available
- Fast turn
- \$30.00/hr. (2 hr. max. + parts)
- UPS paid return

TA Enterprises

986 Cherokee Rd. SE • Palm Bay, FL 32909

407-725-6167

Tim Downey, President

**PAGER REPAIR
Specialize in NEC and
Motorola Pagers!**

Repair • Recrystal • Recode

- Flat rate: \$10 plus parts.
- Quick turnaround
- Paid return with order of 50 pagers+.
- Contract rates negotiable.



Electronic Paging Services, Inc.

1418 Upfield Dr., Ste. 111

Carrollton, TX 75006

(214) 242-1887

Repair services

Triton Electronics, Inc.

Cushman Authorized Service Center

**CALIBRATING FM MONITORS
CUSHMAN FACTORY AUTHORIZED
ALSO SERVICE IFR,
MOTOROLA & GAW
NBS TRACEABLE**

4300 Lincoln Ave., Unit O
Rolling Meadows, IL 60008

(708) 934-6426
FAX (708) 934-7195

*****PRIORITY*****

IFR REPAIR & CALIBRATION

(24 HRS-72 HRS HIGH PRIORITY REPAIR AVAILABLE)

Service Monitors (IFR)(Motorola)(Cushman)	Our Cal. Lab is staffed with retired military PMEL personnel to whom quality has been a way of life for over 20 years—we do quality work at a lower price.
Micro Voltmeters	2801 17th Avenue
RF Millivoltmeters	Gulfport, MS 39501
Noise Gen. & Test Sets	(601) 868-6596
Sweep Generators	(601) 896-6596
Oscilloscopes	FAX: (601) 868-0133 (24 HRS)
Signal Conditioning Equipment	(ORDERS) 1-800-476-ALCOM
Signal Generators	
Frequency Selective Voltmeter	
Frequency Counters	
Oscillators	
Spectrum Analyzers	
Power Meters	

ALCOM ELECTRONICS EXCHANGE, INC.

N.I.S.T. TRACEABLE

Circle (125) on Fast Fact Card

CUSHMAN SERVICE CENTERS

THESE ARE THE **ONLY** FACTORY AUTHORIZED CUSHMAN SERVICE CENTERS

TRITON ELECTRONICS, INC.
4300 LINCOLN AVE., UNIT O
ROLLING MEADOWS, IL 60008
FAX (708) 934-7195
(708) 934-6426

CUSHMAN ELECTRONICS, INC.
2144 BERING DRIVE
SAN JOSE, CA 95131
FAX (408) 432-8359
(408) 432-8100

NS ELECTRONICS SERVICE, INC.
3610 DEKALB TECH. PKWY.
SUITE 110/111
ATLANTA, GA 30340
FAX (404) 458-8785
(404) 451-3264

*New and Used Instruments Available.
Models: 6030, 7120, 7130, CE15, CE200, CE201.*

Circle (126) on Fast Fact Card

PAGER REPAIR

NATIONWIDE REPAIR CENTER

- NEC - MOTOROLA - PANASONIC
- \$10 Flat Rate Labor
- 60-Day Complete Warranty
- Excellent Turn-Around
- Contract Service - Specials



TELECOMM SERVICES, INC.

13625 Inglewood Ave., Hawthorne, CA 90250
Tel: (213) 676-7838 FAX: (213) 679-5681

Circle (127) on Fast Fact Card

**Make your
classified ad
stand out.**

Use color!

PAGER REPAIR

Low-cost conversion
Discounts for quantity
Repair: Flat rate-\$10 plus parts.

Call Pager Communications
for quotes: (512) 341-6514

Sales offices

Associate Publisher/National Sales Manager

Mercy Contreras
First National Bank Building
333 W. Hampden, Suite 608
Englewood, CO 80110
Telephone: 303-762-1248
telefax: 303-762-0069

MIDWEST: Englewood, CO
Diane Hite, Marketing Manager
First National Bank Building
333 W. Hampden, Suite 608
Englewood, CO 80110
Telephone: 303-762-1249
Telefax: 303-762-0069

EAST: Englewood, CO
Ruth Breashears
First National Bank Building
333 W. Hampden, Suite 608
Englewood, CO 80110
Telephone: 303-762-1249
Telefax: 303-762-0069

WEST: San Rafael, CA
Dennis Hogg, Marketing Manager
950 N. Gate Drive, Suite 207
San Rafael, CA 94903
Telephone: 415-491-1442
Telefax: 415-491-1842

CLASSIFIED SALES, Englewood, CO
Carla Gamino, Classified Marketing Manager
First National Bank Building
333 W. Hampden, Suite 608
Englewood, CO 80110
303-762-1249
Telefax: 303-762-0069

EUROPE:
Nicholas McGeachin
Roseleigh House
New Street, Deddington
Oxford, OX5 4SP England
Telephone: (0869) 38794
Telefax: (0869) 38040
Telex: 837469 BES G

JAPAN:
Masahiro Yoshikawa
Orient Echo, Inc., 1101 Grand Maison
Shimomiyabi-Cho, 2-18, Shinjuku-ku,
Tokyo 162 Japan
Telephone: 03-235-5961
Telex: J-33376 MYORIENT

A *d index/hotline*

Company	Page Number	Fast Fact Number	Advertiser Hotline	Company	Page Number	Fast Fact Number	Advertiser Hotline
AAA Communication Mfgs.	81	108	800/283-5158	Interconnect Specialists, Inc.	58	47	407/332-0533
AAT Communications, Corp.	86	122	718/979-6600	International Crystal Mfg.	55		405/236-3741
Advanced Electronic Applications, Inc.	44	36	206/775-7373	Leavitt Comms	81	110	708/676-8282
AIE Corporation	71	68	803/532-9256	Manon Engineering Inc.	79	103	206/827-7449
Antenna Specialists Co.	IFC	1	216/349-8400	Marconi Instruments	27	22	800/233-2955
Apco National Conference	74	74	800/824-1850	Meridian	51	44	818/888-7000
Atkinson Dynamics	30	25	415/583-9845	Micro-Quick Systems, Inc.	72	71	714/980-1034
Avcom of Virginia	18	13	804/794-2500	Micro-Quick Systems, Inc.	85	118	714/980-1034
Avtec, Inc.	61	50	803/892-2181	Microflex	60	49	503/363-9267
B-D Crystal	77	96	606/283-5000	Midian Electronics, Inc.	28	23	602/884-7981
Band-It-Index	57	46	303/320-4555	Midland International LMR	37	30	800/MID-LAND
Barnett Electronics	78		800/423-3858	Multiplier Industries Corp. 32A-32B			800/642-2424
BEE Electronics	22	17	800/336-3115	MX-Com, Inc.	9	9	919/744-5050
Bulldog Domestic Fasteners	83	114	805/473-3161	Norcomm Corp.	72	70	800/874-8663
C T Systems	35	29	800/245-6356	Orbacom Systems, Inc.	53	76	609/829-4455
Cadex Electronics, Inc.	74	75	604/522-8046	Parkinson Electronics Co.	83	115	800/332-7003
Celltronics	59	48	619/587-0656	Polyphaser Corp.	73	72	702/782-2511
Celwave	43	35	201/462-1880	Primus Electronics Corp.	62	53	800/435-1636
Centurion International, Inc.	13	10	800/228-4563	Quality Telecom Supply, Ltd.	67,68	60,62	403/293-1965
Centurion International, Inc.	80	106	800/228-4563	Quality Telecom Supply, Ltd.	70	66	403/293-1965
CES, Inc.	7	7	800/327-9956	Ramsey Electronics	64	55	716/586-3950
Comms Products of Nevada	80	104	702/877-3180	Repco, Inc.	19	14	407/843-8484
Communications Associates	77	99	800/435-9313	Rocky Mountain Comms, Inc.	85		303/988-3395
Communications Specialists	BC	3	800/854-0547	Scala Electronic Corp.	63	54	503/779-6500
Computer Resources, Inc.	50	43	205/591-8810	Schlumberger Instruments	47	39	617/229-4825
Connect Systems, Inc.	17	12	805/642-7184	Securiton Co.	22	18	408/263-6434
Control Signal Corp.	24	20	303/989-8000	Selectone Corp.	40	33	800/227-0376
Cushcraft/Signals Corp.	21	16	603/627-7877	Sharp Communication	82	112	800/548-2484
Cushman Electronics, Inc.	87	126	404/451-3264	Shinwa Communications of America	70	67	405/232-7272
Cybersym Control Sys.	84	117	703/268-5400	Shure Brothers, Inc.	25,48	21,40	800/257-4873
D&R Associates	30	26	309/693-0666	Solid State Communications	3	5	415/785-4610
Daniels Electronics, Ltd.	8	8	604/382-8268	Standard Comms	82	111	800/251-1357
Data Signal, Inc.	38	31	912/883-4703	Standard Communications Corp.	49	41	213/532-5300
Decibel Products, Inc.	23	19	214/631-3010	Statistical Control Systems Corp.	71	69	813/954-8816
Delcom Radio Ltd.	78	102	415/592-8790	Sti-Co Industries, Inc.	46	38	716/881-3287
Doppler Systems, Inc.	62	51	602/488-9755	Telecomm Services, Inc.	87	127	213/676-7838
Dynatech Tactical Communications, Inc.	20	15	800/233-8639	Telewave, Inc.	41	34	415/968-4400
Earmark, Inc.	62	52	203/777-2130	Tessco	15	11	800/638-7666
Gamber-Johnson	73	73	800/826-0440	Transcript Intl., Inc.	5	6	800/228-0226
General Communications	80	105	800/356-3200	Trident Micro Systems	68	63	714/549-5206
GLB Electronics, Inc.	50	42	716/534-5280	Vega	1	4	818/442-0782
Glenayre Electronics	33	28	206/575-0888	Vocom Products Corp.	66	58	312/885-3296
Hark Electronic Systems	39	32	803/747-2988	Wacom Products, Inc.	69	64	817/848-4435
HCS Telecommunications	65	56	800/346-6442	Yaesu USA	IBC,26		213/404-2700
Helper Instruments Co.	63,66	57,77	800/327-9308	Zetron, Inc.	29	24	206/820-6363
Henry Radio	45	37	213/820-1234				
Hutton Communications	65,67	59,61	800/442-3811				
Hutton Communications	69	65	800/442-3811				
IDA Corp.	54	45	701/280-1122				
IFR Systems, Inc.	31	27	316/522-4981				
Il Morrow, Inc.	76						

Jack of All Trades

Medic? Patrolman? Hard hat? Fireman? Trucker? Watchman? No matter, there's a Yaesu handheld or mobile radio that's just right to meet your special demands. The right combination of advanced features, the right size, the right weight, the right price, and most important, the right quality...

Yaesu quality. Because making quality radios for your "trade" is our "trade." And we're good at it.

Pictured below are the: FTL-2001 VHF mobile radio, FTL-7002 UHF mobile radio, SP-4 speaker, FP-700 power supply, MD-2B8 microphone, FTH-2009 VHF handheld, FTH-2008 VHF handheld, FTH-7008 UHF handheld, NC-29 battery

charger, NC-33 multiple battery charger, FTT-4 signaler, MH-12A2B speaker microphone, MH-18A2B miniature speaker microphone, FTH-2070 dual-band handheld, MH-20A2B speaker microphone, NC-35 battery charger, NC-36 battery charger, FTR-2410B FM repeater.

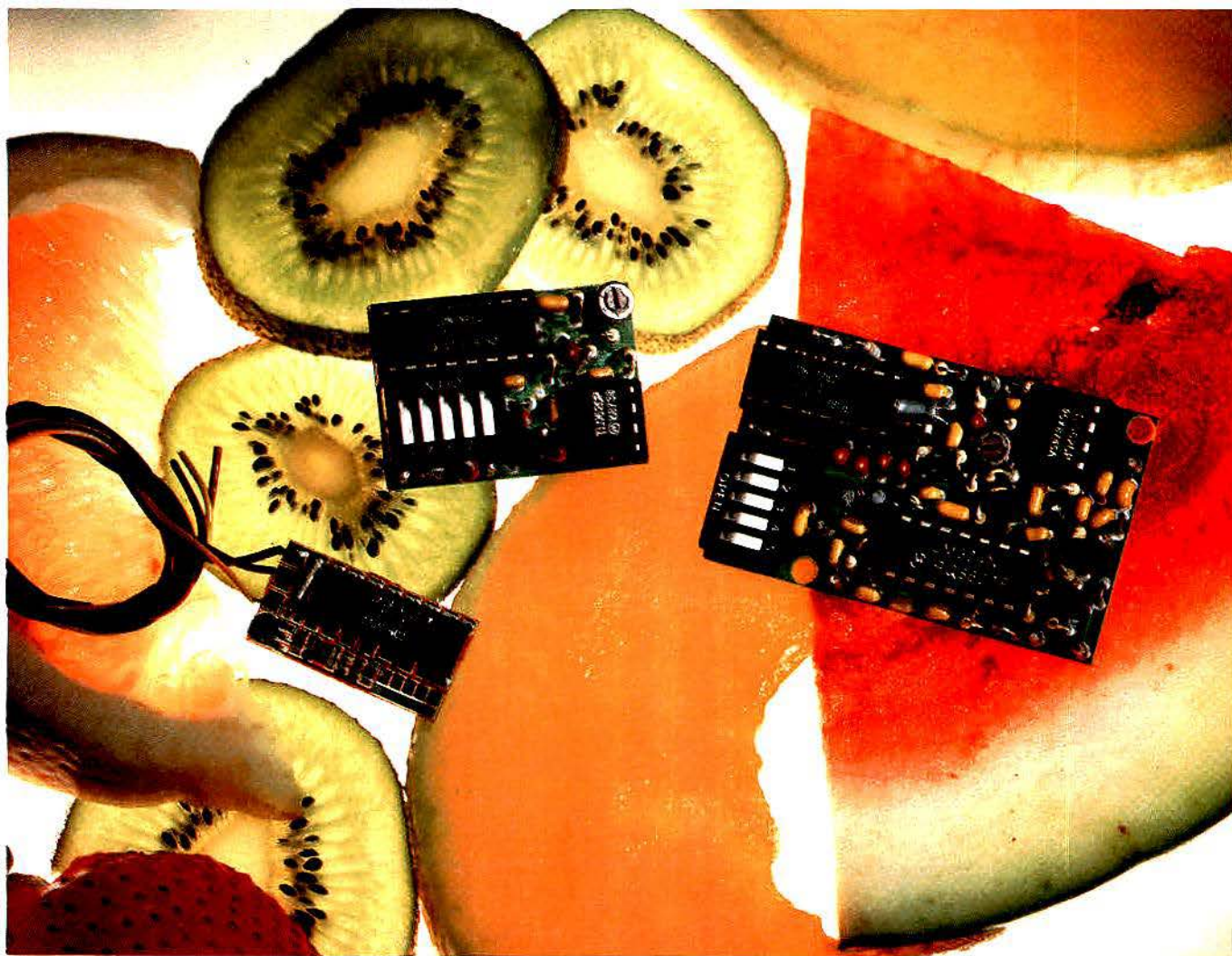
For further information on Yaesu's commercial product line, call toll-free 1-800-999-2070.

YAESU U.S.A.

Performance without compromise.



Good at All.



Choice Selection.

Now you can have it all! Take all the qualities you've come to depend on in our programmable CTCSS tone equipment: Astonishing Accuracy, Instant Programming, Unequaled Reliability; and add full spectrum tone versatility, multi-tone capability without diodes, a reprogrammable memory... It's our new harvest of CTCSS tone equipment.

The choice is yours! If standard CTCSS EIA tones do not suit your taste, select any 32 tones of your liking from 15.0Hz to 255.0Hz. And if you change your mind, no problem; the memory can be changed in your shop with our HHP-1 programmer, or at our factory for free. Your working tone is accessed by a simple DIP switch, so there's no fussing with counters or other test equipment.

Call today toll-free and find out more about this fresh new flexibility in tone signalling, and don't forget to ask about multi-tone switching without cumbersome diode networks or binary switches.

It's all brought to market by the people who introduce the freshest ideas in tone signalling, and of course our customary same day shipping and one year warranty apply.

TS-32P CTCSS ENCODER-DECODER Based on the time proven TS-32, the industry standard for over a decade. The TS-32P gives you the added versatility of a custom, changeable memory base. A low price of \$57.95 makes it an even sweeter deal.

SS-32P ENCODER Based on the equally popular SS-32 encoder. Available for CTCSS, or audible burst tones up to 6550.0Hz. Price is \$28.95.

SS-32SMP SUB-MINIATURE ENCODER Our smallest encoder for handheld applications. Now you can satisfy that customer that needs to access multiple repeater sites with a radio that has precious little space inside. At \$27.95, the price is small too.

HHP-1 HANDHELD PROGRAMMER For programming the 32 memory locations in any of our new programmable products, including our SD-1000 Two-Tone Sequential decoder. The HHP-1 is battery operated for field use, and will program ANY 32 tones from 15.0 to 6550.0Hz in .1Hz. increments. Price is \$199.95.



COMMUNICATIONS SPECIALISTS, INC.

426 West Taft Avenue • Orange, CA 92665-4296
Local (714) 998-3021 • FAX (714) 974-3420 • Entire U.S.A. 1-800-854-0547

Circle (3) on Fast Fact Card